NUEXCO

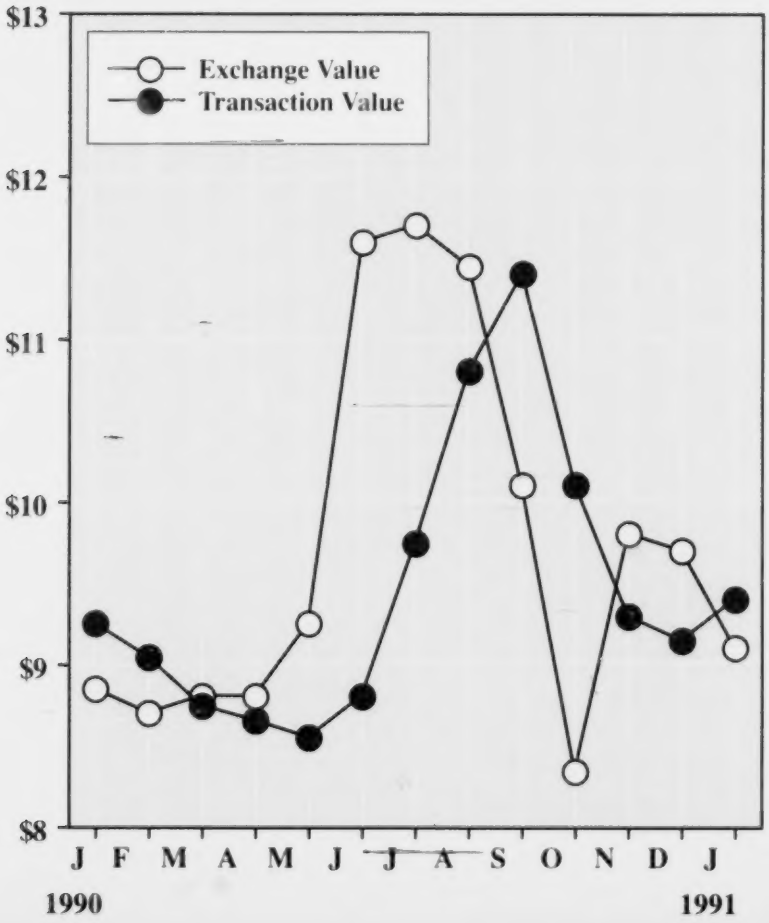
Monthly Report

February 1991 Number 270

When Will Nuclear Power Return? 17

Uranium Industry of Eastern Germany 22

1990 Exploration and Development in North America 29



NUEXCO

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ISSN 0742-4582

NUEXCO Monthly Report

February 1991
No. 270

Published by:
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- **Uranium Industry of Eastern Germany**
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To Our Readers

We would like to draw your attention to the revised mailing address of the Denver headquarters of CONCORD and NUEXCO. The suite number has been changed to Suite 1000, although the former address of suite 900 is still valid and mail sent to the old address will still be received. The new complete address is given below and is also included on the front inside cover.

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* * *

We are pleased to announce that CONCORD, under the name of CONCORD Resources, Ltd., has opened a new office in London as of February 1, 1991. Mr. Berwyn Edwards will serve as the Office Director of Operations, coordinating the affairs of the various CONCORD Business Units. The address is given below.

CONCORD Resources, Ltd.
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London SW1 HOHW ENGLAND
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The personnel of CONCORD Resources, Ltd., which include our NUEXCO Commercial Representatives formerly located in Geneva, will represent various CONCORD Business Units including the Nuclear Fuel Cycle Business Unit (NUEXCO). NUEXCO's two principal trading entities will continue to be located in Denver (NUEXCO Trading Corporation) and Zurich (NUEXCO Exchange AG in Olten, Switzerland).

* * *

NUEXCO is also pleased to announce that Chris von Christierson has joined the CONCORD organization on January 1, 1991 as an Executive Director, where he will have an executive role in CONCORD's world-wide operations. Chris, who has represented NUEXCO in South Africa for more than fifteen years, will be based in CONCORD Resources, Ltd.'s London office, and will also remain actively involved in Africa as CONCORD's Area Director of Operations.

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Market Values Summary

NUEXCO Market Values	This Report January 31, 1991	Last Report December 31, 1990	12 Months Ago January 31, 1990
EXCHANGE VALUE[1]	**$9.10**/lb equivalent U_3O_8	$9.70	$8.85
UF_6 VALUE[2]	**$27.50**/kg U as UF_6	$28.75	$25.90
LOAN RATE[3]	**3.5%**/annum	3.5%	3.5%
CONVERSION VALUE[4]	**$1.45**/lb U as UF_6	$1.45	$1.50
SWU VALUE[5] **(0.3% tails assay)**	**$51**/SWU	$51	$54
TRANSACTION VALUE[6]	**$9.40**/lb equivalent U_3O_8	$9.15	$9.25
Transactions	**18**	19	17
Months	**3**	3	3
Millions of Pounds	**3.1**	3.1	4.0

DEFINITIONS

1 The **Exchange Value** is NUEXCO's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

2 The **UF_6 Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.

3 The **Loan Rate** is NUEXCO's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

4 The **Conversion Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

5 The **SWU Value** is NUEXCO's judgment of the price at which spot and near-term transactions for significant quantities of enrichment services could be concluded as of the date indicated.

6 The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:

a) Transactions closed within the previous three month period for which delivery is scheduled within one year of the transaction date;

b) At least ten transactions;

c) Transactions involving a sum total of at least 2 million pounds equivalent U_3O_8.

DERIVATIONS AND COMMENTS

- All **Market Values** are expressed in terms of US$.
- All **Market Values** are based on:
  - Data from recently completed transactions.
  - Data from pending transactions.
  - Firm bids to buy or borrow, and firm offers to sell or lend.
  - Prices purchasers or rates borrowers have expressed a willingness to pay, but for which NUEXCO is not aware of firm bids to buy or borrow and prices sellers or rates lenders have expressed a willingness to accept, but for which NUEXCO is not aware of firm offers to sell or lend.
- Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not included in the determination of these **Market Values**.
- In the determination of prices, NUEXCO does not consider charges for transportation other than that customarily provided by suppliers.
- The prices of services or materials delivered under long-term contracts with primary suppliers are not considered in the determination of the listed values.
- For the **SWU Value**, NUEXCO converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight percent U^{235} and a product assay of 3.0 weight-percent U^{235}, assuming feed costs corresponding to the NUEXCO **Exchange Value** and **Conversion Value** determined as of the same date.
- In calculating the **Transaction Value**, NUEXCO does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future **Exchange Values** or any other indeterminate variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it can not currently be determined.
- The sample time for the **Transaction Value** is extended as necessary to satisfy the minima for the number of transactions and quantity of material. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

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MARKET REVIEW

JANUARY MARKET REVIEW

(as of January 31, 1991)

OVERVIEW

The January 31, 1991 Exchange Value fell $0.60, to $9.10 per pound U_3O_8. The UF_6 Value also dropped, falling $1.25, to $27.50 per kgU as UF_6. Both markets declined early in the month and then stabilized in the last half of the month near their January 31 Market Values. Five near-term natural uranium sales were reported for a total of nearly one million pounds equivalent U_3O_8. January 1991's volume seems low compared to 1990's total sales volume which exceeded 40 million pounds, but January has typically been one of the least active months. The average monthly sales volume of the previous three Januarys (1988-1990) is approximately 900 thousand pounds equivalent U_3O_8.

The Conversion Value, Loan Rate, and SWU Value all remained unchanged, at $1.45 per pound U as UF_6, 3.5 percent per annum, and $51 per SWU, respectively.

NATURAL URANIUM AND CONVERSION

The **Exchange Value** declined six percent, to **$9.10** per pound U_3O_8. Twice in the latter half of 1990, market prices rose suddenly, only to be followed by equally sharp declines. During January, sellers competed aggressively early in the month, but grew increasingly cautious as prices approached the nine dollar level late in the month. Observing this pattern of declining prices, some buyers delayed their market entry in an attempt to time their purchases with a price bottom.

Five near-term natural uranium sales were reported for January, totalling slightly less than one million pounds equivalent U_3O_8. Sales prices ranged from slightly below December 31, 1990 Market Values to levels at or near the January 31, 1991 Market Values. All five buyers (four of which were utilities) were from the USA. At least four of the five sellers were from the USA as well; the fifth seller is unknown.

* * *

The **UF_6 Value** also declined, falling four percent, to **$27.50** per kgU as UF_6. The concentrates market and UF_6 market continued to move in parallel as buyers were generally receptive to offers of either form, although there was a small premium for UF_6 compared to the sum of the values of its components. Total near-term natural uranium sales volume was about equally split between UF_6 and concentrates.

* * *

The **Transaction Value** rose $0.25, to **$9.40** per pound U_3O_8 based on 18 transactions over 3 months involving 3.1 million pounds equivalent U_3O_8. The higher-priced sales of December and early January contributed to the increase in the Transaction Value.

* * *

Table 1
NEAR-TERM URANIUM SALES SUMMARY

	January 1991		Year-to-Date	
	No. of Sales	Volume[1]	No. of Sales	Volume[1]
Concentrates	3	0.5	3	0.5
Natural UF_6	2	0.5	2	0.5
EUP	0	0.0	0	0.0
Total	**5**	**1.0**	**5**	**1.0**

[1] million pounds equivalent U_3O_8

Table 2
NEAR-TERM SUPPLY/DEMAND SUMMARY

	Active Supply[1]	Active Demand[1]
• Uranium (thousand lbs equivalent U_3O_8)	5,200	1,600
• Supply/Demand Ratio:	3.2	
• Loan (thousand lbs equivalent U_3O_8)	10,565	0
• Conversion (thousand lbs U as UF_6)	920	630
• SWU (thousand SWUs)	650	495

[1] Supply and demand tables in the Market Review section of this Report provide details for each category.

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Active uranium supply increased from 4.4 million pounds to **5.2** million pounds equivalent U_3O_8 (**Table 2**). **Active uranium demand** decreased slightly, to **1.6** million pounds equivalent U_3O_8. As a result, the **supply/demand ratio** climbed to **3.2**.

* * *

Only one sale was reported in the **long-term natural uranium market**. A US utility purchased one million pounds equivalent U_3O_8 for delivery during the period 1993-1996.

* * *

The **Loan Rate** for natural uranium remained unchanged at **3.5** percent per annum. Two loans, totalling 1.5 million pounds equivalent U_3O_8, were reported in January. For the first time, reported loan supply now exceeds 10 million pounds equivalent U_3O_8 (**Table 2**). No inquiries to borrow are reported. Demand for loans remains low and with such an abundance of supply, any loan demand that does emerge is filled almost immediately.

* * *

The **Conversion Value** was also unchanged, remaining at **$1.45** per pound U as UF_6 for the eleventh consecutive month. Three conversion sales were reported in January for a total exceeding 1.5 million pounds U as UF_6. Two utilities made spot purchases, while the other sale calls for intermediate-term delivery.

* * *

ENRICHMENT SERVICES AND ENRICHED URANIUM PRODUCT

The **SWU Value** remained at **$51** per SWU. Despite only one secondary enrichment transaction being reported in January, in which a US utility purchased a very small quantity of SWU from an intermediary, the SWU market is more active than it has been in nearly a year. At least seven utilities have, either formally or informally, requested offers for potentially over 500 thousand SWU for near-term delivery. The long-term SWU market has also been fairly active with three utilities seeking long-term offers for a portion of their requirements. Although ample SWU supplies are available to fill this demand, the direction of the SWU market will be determined by the willingness of suppliers to sell at current market prices, and the timing of this new demand.

Table 3
ENRICHMENT PRICES
(January 31, 1991)

Prices	This Month Report 270	Last Month Report 269	12 Months Ago Report 258
NUEXCO SWU Value ($US per SWU)	51	51	54
US DOE SWU prices: ($US per SWU)			
USEC	117.85[1]	117.85[1]	117.85[1]
AFC	153.00[3]	153.00[3]	153.00[3]
Requirements	157.00[3]	157.00[3]	157.00[3]
Incentive Price (IP2)[4]	100.60[4]	100.60[4]	90.00[5]
Calculated worth of enriched UF_6[6]: ($US per KgU as UF_6)			
2.0 w/o U_{235}	198	205	201
2.5 w/o U_{235}	274	282	279
3.0 w/o U_{235}	352	362	359
3.5 w/o U_{235}	431	444	440
4.0 w/o U_{235}	512	526	523
4.5 w/o U_{235}	593	609	607

[1] Effective 10/1/89 to 9/30/91.
[2] Effective 10/1/87 to 9/30/89.
[3] Effective since 10/1/84.
[4] IP2: Effective 10/1/90 to 9/30/91, for up to 30% of annual requirements.
[5] Used Incentive Price IP1 – effective 10/1/86 to 9/30/90, for up to 30% of annual requirements.
[6] Calculated using the NUEXCO Exchange Value, Conversion Value, SWU Value and 0.30 w/o tails assay.

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MARKET REVIEW

RECENT TRANSACTIONS

Uranium Sales[1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U_3O_8)	Price Within Percentage Range[2] of Current Exchange or UF_6 Value	Buyer	Seller	Remarks
5026	1991	Less Than 50	103-110	Utility	Convertor	UF_6
5032	1991	Less Than 50	103-110	R	Intermediary	
5036	1991	101-300	103-110	Utility	Producer	
5037	1991	301-600	98-102	Utility	Intermediary	UF_6
5041	1991	101-300	98-102	Utility	Intermediary	
5043	1993-96	601-1,000	See Remarks	Utility	R	Price Related To Market

R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

[1] Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

[2] The ranges *Below 90, 90-97, 98-102, 103-110, Above 110*, represent percentages (rounded to whole numbers) of the appropriate current Exchange Value or UF_6 Value. The endpoints of each range are included within that range.

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RECENT TRANSACTIONS

Natural Uranium Loans [1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds equivalent U_3O_8)	Price Within Percentage Range [2] of Current Loan Rate	Borrower	Lender	Remarks
5038	1991	601-1,000	98-102	Producer	Utility	
5040	1991	301-600	98-102	Intermediary	Utility	

Conversion Sales [1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity (thousand pounds of U equivalent)	Price Within Percentage Range [2] of Current Conversion Value	Buyer	Seller	Remarks
5025	1991	101-300	R	Utility	Intermediary	Occurred in 1990
5034	1991-92	1,001-3,000	R	R	Convertor	
5042	1991	101-300	98-102	Utility	Intermediary	

Enrichment Sales [1]

NUEXCO Transaction Number	Delivery Period	Approximate Quantity [3] (thousand SWU)	Price Within Percentage Range [2] of Current SWU Value [4]	Buyer	Seller	Remarks
5035	1991	Less Than 50	R	Utility	Intermediary	

R means that NUEXCO either does not know, or that NUEXCO has restricted that information to protect client or source confidentiality.

[1] Transactions listed are not limited to those in which NUEXCO was involved, but also include others of which NUEXCO is aware. NUEXCO may delay reporting some transactions in order to protect proprietary information.

[2] The ranges *Below 90, 90-97, 98-102, 103-110, Above 110*, represent percentages (rounded to whole numbers) of the appropriate current Market Value. The endpoints of each range are included within that range.

[3] If tails assay is unknown or unspecified, NUEXCO's calculation of SWU quantity assumes 0.30 w/o tails assay.

[4] Prices are usually normalized to 0.30 w/o tails assay. When prices and SWU values are expressed as discounts from a reference price (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage price range is based on the discounted prices, not on the reference price.

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MARKET REVIEW

SUPPLY AND DEMAND

Uranium Supply

NUEXCO Project Number	Quantity (Thousand Pounds equivalent U_3O_8) Spot or Near-term[1]	Intermediate or Long-term[2]	Delivery Period	Remarks
Available for Sale:				
ACTIVE				
90-1078A	700	1,045 per year	1991-1993	UF_6e
90-1227	500	—	1991	
90-1231	500	500 per year	1991-1995	
90-1249*	500	—	1991	
90-7001*	3,000	1,000 per year	1991-1995	U_3O_8/UF_6
Total	**5,200**			
INACTIVE	**4,100**			
Available for Loan:				
ACTIVE				
88-1182	4,400	—	—	U_3O_8/UF_6
90-1016	1,000	—	—	U_3O_8
90-1108	1,000	—	—	U_3O_8
90-1180	525	—	—	U_3O_8
90-1230	1,000	—	—	U_3O_8
90-1260	1,000	—	—	UF_6
90-1275	100	—	—	U_3O_8
91-1007*	780	—	—	U_3O_8
91-1009*	260	—	—	U_3O_8
91-1018*	500	—	—	U_3O_8
Total	**10,565**			
INACTIVE	**1,000**			

*New or revised since last month.

[1] For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.

[2] For delivery beyond one year, measured from the date of this Report.

Active Projects reclassified as Inactive since last month: *none*
Active Projects removed since last month: *none*

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SUPPLY AND DEMAND

Uranium Demand

NUEXCO Project Number	Quantity (Thousand Pounds equivalent U_3O_8) Spot or Near-term [1]	Intermediate or Long-term [2]	Delivery Period	Remarks
Inquiries to Purchase:				
ACTIVE				
90-1100A	45	—	1991	UF_6e
90-1239A	160	—	1991	UF_6e
90-1267*	100	—	1991	
90-1293	200	—	1991	
91-1003A*	750	—	1991	UF_6e
91-1010A*	85	—	1991	UF_6e
91-1013*	250	—	1991	
91-1029A*	10	—	1991	UF_6e
90-1170	—	290	1992-1996	
90-1240	—	260 per year	1994-1996	U_3O_8/UF_6
90-1256	—	500 per year	1994-1998	U_3O_8/UF_6
90-1291*	—	100 per year	1991-1995	
91-1014A*	—	6,800	1992-2001	UF_6e
91-1017*	—	300 per year	1995-2000	
TOTAL	**1,600**			
INACTIVE	**3,355**			
Inquiries to Borrow	*No inquiries to borrow are reported*			

* New or revised since last month.

[1] For delivery within one year, measured from the date of this Report. This category excludes material deliverable within one year under other than spot or near-term contracts.

[2] For delivery beyond one year, measured from the date of this Report.

Active Projects reclassified as Inactive since last month: 90-1289
Active Projects removed since last month: 90-1226, 90-1235B, 90-1254A, 90-1292, 90-1302

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SUPPLY AND DEMAND

Conversion Supply And Demand

NUEXCO Project Number	Quantity (Thousand Pounds U as UF_6) Within 3 Years [1]	Beyond 3 Years [1]	Delivery Period	Remarks
Available for Sale:				
ACTIVE				
91-1033*	220	—	1991	
91-7000	300	—	1991	
91-7001	400	—	1991	
TOTAL	**920**			
INACTIVE	*None reported*			
Inquiries to Purchase:				
ACTIVE				
91-1003C*	630	—	1991	
Total	**630**			
INACTIVE	*None reported*			

* New or revised since last month.

[1] Measured from the date of this Report.

Active Projects reclassified as Inactive since last month: *none*
Active Projects removed since last month: 90-1254C, 90-1259, 90-1306

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SUPPLY AND DEMAND

SWU Supply And Demand

NUEXCO Project Number	Quantity (Thousand SWUs) Spot or Near-term[1]	Intermediate or Long-term[2]	Delivery Period	Remarks
Available for Sale:				
ACTIVE				
88-1006*	150	—	1991	
90-1078B	200	435 per year	1991-1993	UF6e
91-1008*	150	—	1991	
91-1032*	150	—	1991	
90-7000	—	1,000	1991 on	
Total	**650**			
INACTIVE	**500**			
Inquiries to Purchase:				
ACTIVE				
90-1100B	15	—	1991	UF6e
90-1224	40	100 per year	1991-1995	
90-1239B	50	—	1991	UF6e
91-1001*	75	—	1991	
91-1003B*	170	—	1991	UF6e
91-1010B*	20	—	1991	UF6e
91-1023*	60	120	1991-1995	
91-1025*	60	—	1991	
91-1029B*	5	—	1991	UF6e
90-1076	—	350 per year	1992-1998	
90-1094	—	500	1992-2000	
90-1144	—	60 per year	1992-2001	
90-1181	—	600	1996-2003	UF6e
90-1196	—	60 per year	1995 on	
90-1301	—	1,000 per year	1995-2000	
91-1014B*	—	1,770	1992-2001	UF6e
91-1027*	—	55 per year	1996-2000	
91-1028*	—	125	1995-1996	
Total	**495**			
INACTIVE	**150**			

* New or revised since last month.

[1] For delivery within one year, measured from the date of this Report. This category excludes SWU deliverable within one year under other than spot or near-term contracts.

[2] For delivery beyond one year, measured from the date of this Report.

Active Projects reclassified as Inactive since last month: *none*
Active Projects removed since last month: 88-1061

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MARKET REVIEW

MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

Exchange Value[1]

Country (currency)	per lb equivalent U_3O_8 as Concentrates			per kg U as Concentrates		
	This Month (Jan. 31, 1991)	Last Month (Dec. 31, 1990)	12 Months Ago (Jan. 31, 1990)	This Month (Jan. 31, 1991)	Last Month (Dec. 31, 1990)	12 Months Ago (Jan. 31, 1990)
Australia (dollar)	11.59	12.58	11.58	30.14	32.71	30.10
Belgium (franc)	280.09	299.57	313.27	728.16	778.81	814.44
Canada (dollar)	10.57	11.25	10.52	27.47	29.25	27.34
EC (ecu)	6.63	7.17	7.28	17.23	18.64	18.94
Finland (markka)	32.87	35.13	35.49	85.44	91.34	92.26
France (franc)	46.04	49.32	51.14	119.68	128.23	132.96
Germany (mark)	13.57	14.50	15.06	35.27	37.70	39.16
Italy (lira)	10,171	10,922	11,204	26,442	28,395	29,128
Japan (yen)	1,195	1,309	1,286	3,106	3,402	3,343
Netherlands (guilder)	15.25	16.35	16.99	39.65	42.50	44.18
So. Africa (comm. rand)	23.18	24.88	22.55	60.26	64.68	58.62
So. Korea (won)	6,525	6,931	6,068	16,963	18,018	15,776
Spain (peseta)	847.69	927.79	967.11	2,204	2,412	2,514
Sweden (krona)	50.61	54.56	54.90	131.58	141.83	142.73
Switzerland (franc)	11.52	12.38	13.31	29.96	32.18	34.60
Taiwan (dollar)	242.29	258.36	231.25	629.91	671.69	601.20
UK (pound)	4.64	5.04	5.28	12.07	13.10	13.73
US (dollar)	9.10	9.70	8.85	23.66	25.22	23.01

Transaction Value[1]

Country (currency)	per lb equivalent U_3O_8 as Concentrates			per kg U as Concentrates		
	This Month (Jan. 31, 1991)	Last Month (Dec. 31, 1990)	12 Months Ago (Jan. 31, 1990)	This Month (Jan. 31, 1991)	Last Month (Dec. 31, 1990)	12 Months Ago (Jan. 31, 1990)
Australia (dollar)	11.97	11.87	12.10	31.13	30.85	31.46
Belgium (franc)	289.32	282.58	327.43	752.17	734.65	851.25
Canada (dollar)	10.91	10.61	10.99	28.37	27.59	28.58
EC (ecu)	6.85	6.76	7.61	17.80	17.59	19.79
Finland (markka)	33.95	33.14	37.09	88.26	86.16	96.43
France (franc)	47.55	46.53	53.46	123.63	120.96	138.97
Germany (mark)	14.02	13.68	15.74	36.44	35.56	40.93
Italy (lira)	10,506	10,303	11,710	27,314	26,785	30,444
Japan (yen)	1,234	1,234	1,344	3,209	3,209	3,494
Netherlands (guilder)	15.76	15.42	17.76	40.96	40.09	46.17
So. Africa (comm. rand)	23.94	23.47	23.57	62.25	61.01	61.27
So. Korea (won)	6,740	6,538	6,343	17,522	16,996	16,489
Spain (peseta)	875.64	875.18	1,011	2,276	2,275	2,628
Sweden (krona)	52.28	51.46	57.38	135.92	133.79	149.18
Switzerland (franc)	11.90	11.68	13.91	30.95	30.35	36.17
Taiwan (dollar)	250.28	243.71	241.70	650.67	633.60	628.38
UK (pound)	4.79	4.75	5.52	12.47	12.35	14.35
US (dollar)	9.40	9.15	9.25	24.44	23.79	24.05

[1]Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

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MARKET VALUES EXPRESSED IN SELECTED CURRENCIES

Conversion Value[1]

Country (currency)	per lb U as UF_6			per kg U as UF_6		
	This Month (Jan. 31, 1991)	Last Month (Dec. 31, 1990)	12 Months Ago (Jan. 31, 1990)	This Month (Jan. 31, 1991)	Last Month (Dec. 31, 1990)	12 Months Ago (Jan. 31, 1990)
Australia (dollar)	1.85	1.88	1.96	4.07	4.15	4.33
Belgium (franc)	44.63	44.78	53.10	98.39	98.72	117.06
Canada (dollar)	1.68	1.68	1.78	3.71	3.71	3.93
EC (ecu)	1.06	1.07	1.23	2.33	2.36	2.72
Finland (markka)	5.24	5.25	6.01	11.55	11.58	13.26
France (franc)	7.34	7.37	8.67	16.17	16.25	19.11
Germany (mark)	2.16	2.17	2.55	4.77	4.78	5.63
Italy (lira)	1,621	1,633	1,899	3,573	3,599	4,187
Japan (yen)	190.39	195.60	217.96	419.74	431.23	480.52
Netherlands (guilder)	2.43	2.44	2.88	5.36	5.39	6.35
So. Africa (comm. rand)	3.69	3.72	3.82	8.14	8.20	8.43
So. Korea (won)	1,040	1,036	1,029	2,292	2,284	2,268
Spain (peseta)	135.07	138.69	163.92	297.78	305.76	361.37
Sweden (krona)	8.06	8.16	9.31	17.78	17.98	20.51
Switzerland (franc)	1.84	1.85	2.26	4.05	4.08	4.97
Taiwan (dollar)	38.61	38.62	39.20	85.11	85.15	86.41
UK (pound)	0.74	0.75	0.89	1.63	1.66	1.97
US (dollar)	1.45	1.45	1.50	3.20	3.20	3.31

SWU Value And UF_6 Value[1]

Country (currency)	SWU Value at 0.30 w/o Tails Assay			UF_6 Value per kg U as UF_6		
	This Month (Jan. 31, 1991)	Last Month (Dec. 31, 1990)	12 Months Ago (Jan. 31, 1990)	This Month (Jan. 31,1991)	Last Month (Dec. 31, 1990)	12 Months Ago (Jan. 31, 1990)
Australia (dollar)	64.97	66.15	70.63	35.03	37.29	33.87
Belgium (franc)	1,570	1,575	1,912	846.41	887.89	916.81
Canada (dollar)	59.21	59.16	64.18	31.93	33.35	30.78
EC (ecu)	37.15	37.71	44.45	20.03	21.26	21.31
Finland (markka)	184.19	184.72	216.54	99.32	104.13	103.85
France (franc)	285.01	259.33	312.07	139.12	146.19	149.67
Germany (mark)	76.04	76.24	91.91	41.00	42.98	44.08
Italy (lira)	57,002	57,426	68,363	30,737	32,372	32,789
Japan (yen)	6,696	6,880	7,847	3,611	3,878	3,763
Netherlands (guilder)	85.48	85.96	103.69	46.09	48.46	49.73
So. Africa (comm. rand)	129.90	130.80	137.58	70.05	73.74	65.98
So. Korea (won)	36.567	36,439	37,027	19,718	20,542	17,759
Spain (peseta)	4,751	4,878	5,901	2,562	2,750	2,830
Sweden (krona)	283.95	286.84	334.99	152.95	161.70	160.66
Switzerland (franc)	64.59	65.08	81.22	32.83	36.68	38.95
Taiwan (dollar)	1,358	1,358	1,411	732.20	765.77	676.77
UK (pound)	26.01	26.49	32.22	14.03	14.93	15.45
US (dollar)	51.00	51.00	54.00	27.50	28.75	25.90

[1]Calculated using currency exchange rates published in *The Wall Street Journal* on the last working day of the month.

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RECENT DEVELOPMENTS

SOUTH AFRICA

1990 Uranium Production

Uranium production in South Africa declined in 1990 for the seventh consecutive year, falling nearly 17% from 1989's level, to 6.2 million pounds equivalent U_3O_8 (**Table 1**). Production fell over 15% in the fourth quarter compared to third quarter levels. 1990's lower total production is largely due to the the shutdown of Freegold's Joint Metallurgical Scheme (JMS) operation. The decline in the yearly total is also the result of reductions at Vaal Reefs and much lower production from East Rand Gold and Uranium Company, Ltd. (ERGO). Only one operation showed an increase in 1990 production; Western Areas' increase was primarily due to an increase in ore grade. Low market prices for both gold and uranium, high operating costs, and sanctions remain the primary causes of the difficulties experienced by the South African uranium industry.

At one time, Freegold was South Africa's second largest uranium producer, but it produced no uranium in the fourth quarter of 1990. Freegold tested the feasibility of using higher-grade feedstock following the March 1990 shutdown of the JMS, but it also proved uneconomic and production ceased during third quarter 1990. ERGO also announced that its uranium operations were no longer economically viable, so after continuous decreases in quarterly production rates, ERGO will close down the operation in April 1991.

Vaal Reefs, South Africa's largest uranium producer, also is experiencing economic difficulties. It has announced that production at its west uranium plant has been reduced by 50 percent. In addition, production at its east uranium plant has been suspended for three months until further options have been considered or until economic conditions improve.

Outlook For the Future

The viability of uranium production at South Africa's five remaining producers will continue to erode with high inflation rates, low market prices for gold and uranium, and continued international sanctions against South Africa.

Table 1
SOUTH AFRICA
1990 URANIUM PRODUCTION[1]
(thousands of pounds U_3O_8)

Operation	TOTAL 1989	First Quarter 1990	Second Quarter 1990	Third Quarter 1990	Fourth Quarter 1990	TOTAL 1990	Percent Change[2]
Buffelsfontein	856	190	174	174	161	699	–18.3
ERGO[3]	382	57	57	57	43	213	–44.2
Freegold[4]	978	213	85	70	0	368	–62.4
Hartebeestfontein	759	194	179	179	173	725	–4.5
Vaal Reefs	3,935	948	925	921	780	3,575	–9.1
Western Areas	496	120	135	154	170	579	+16.7
TOTAL[5]	**7,406**	**1,723**	**1,555**	**1,555**	**1,326**	**6,159**	**–16.8**

[1] Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.
[2] Change in percent from the 1989 totals.
[3] ERGO = East Rand Gold and Uranium Company Ltd.
[4] Formerly Free State Joint Metallurgical Scheme.
[5] Columns may not add up due to rounding.

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WASHINGTON FOCUS

by Linda L. Gunter

Congress reconvened January 3, but because attention is focused on the war with Iraq, little was accomplished. Between floor statements about the war, new legislation was introduced and committee assignments were made. As a result of last November's elections, the Democrats increased their majority and thus the ratio of Democrats to Republicans. This allows them to add one or two members to committees. This increase in Democratic influence will be felt in the key committees which consider nuclear issues, including energy and appropriations committees. For example, the Senate Energy and Natural Resources Committee will have five new members—three Democrats, Richard Shelby (D-AL), Wyche Fowler (D-GA), Paul Wellstone (D-MN), and two Republicans, Larry Craig (R-ID) and John Seymour (R-CA). It is too early to predict whether these changes will affect the committees' support for nuclear issues. In the House Interior Committee, the Democrats have voted Representative George Miller (D-CA) Vice-Chairman because Chairman Morris Udall (D–AZ) has been hospitalized since the beginning of the year. Vice-Chairman Miller has the authority to organize the committee and set the agenda until Chairman Udall returns. This change is particularly distressing news for the nuclear industry because Rep. Miller is a vocal critic of the nuclear industry, and has already introduced a bill which would disallow the NRC's Below Regulatory Concern (BRC) waste disposal guidance, issued just last year.

DOE FY92 Budget Request

◇ DOE's FY92 budget request for uranium enrichment increased by about $47 million to $1.387 billion, offset by anticipated revenues of $1.547 billion. However, within the budget, DOE actually cut the operating budget for the gaseous diffusion plants from $1.089 billion in FY91 to $1.037 billion in FY92. Budgetary increases went to environmental clean-up at the plant sites. The AVLIS budget also increased, from $154.5 million to $213.6 million, but spending has been restricted to demonstration of the process only; no money has been allocated for deployment. DOE has determined "based on policy considerations and budgetary restraints on government spending, that the government should avoid investments in the uranium enrichment enterprise that could more appropriately be made by the private sector." All activities leading toward deployment, including implementation of an industrial access program, selection of a commercial deployment contractor, site selection, and preparation of environmental impact statements, are now on hold until either a government corporation is created or until Congress, through the appropriations process, authorizes their continuation. AVLIS deployment was approximately two years behind schedule and this new DOE action will delay the program at least another year.

Uranium Enrichment Legislation

◇ Senator Wendell Ford (D-KY) introduced the Uranium Enrichment Act of 1991 (S–210) on January 15. His new position as Democratic Whip will speed passage of the bill, which is essentially identical to the version passed by the Senate in 1989. In the House, Rep. Bob McEwen (R-OH) reintroduced the administration's bill, the Uranium Enrichment Reorganization Act (HR-145). Although Rep. McEwen is not a member of any of the House committees with jurisdiction for this bill, his new position as a member of the House Rules Committee may be beneficial to efforts to pass the bill, should it ever move beyond the committee hearing stage.

NGA Nuclear Policy Statement

◇ On February 5, the National Governors Association (NGA) endorsed, as part of their nuclear energy policy statement, restructuring of the DOE's uranium enrichment program as a government corporation. The NGA also endorsed federal payment for clean-up of abandoned uranium mines and inactive mill tailings piles. The measure

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states "The Governors support immediate enactment of measures that would help restore viability within the uranium industry as required under Section 161v of the Atomic Energy Act of 1954" ... and "immediate application of US trade laws to counter importation of subsidized natural and enriched uranium and other unfair trade practices." Umetco Minerals Corporation, as one of the last US-owned uranium mining companies, was the primary sponsor of the NGA endorsement.

Legislative Agenda

◇ Although Congress and the Administration are preoccupied by the war with Iraq, discussion continues about legislative priorities for the year. The annual budget and appropriations process should be less contentious than previous years, because the agreement reached last year sets five-year spending limits. A national energy policy should be a priority, but indications are that energy legislation may be delayed until after the war is over. Energy policy options are still being debated within the administration which may delay the presentation of the administration's bill to Congress. Congress has already introduced 25 energy-related bills. Nuclear issues such as spent fuel disposal should receive some attention, and a bill to assist the industry's efforts at constructing the next generation of nuclear power plants may also be considered. Energy security issues will receive more attention this year, relegating the nuclear industry's legislative agenda to a lower priority.

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INDUSTRY BRIEFS

LES Files Application For US Enrichment Plant

Louisiana Energy Services (LES) filed an application with the Nuclear Regulatory Commission (NRC) on January 31, 1991 for a license to construct and operate a uranium enrichment plant. If approved, the LES plant will be the first privately-owned enrichment plant in the USA. The NRC may take up to two years to consider the application. A formal adjudicatory public hearing must be held when the NRC completes its review of the application. Construction on the facility is planned to begin in early 1993, assuming timely NRC approval of the license. LES has stepped up its efforts to gain financial commitments for construction and also increased its efforts to market the plant's potential production.

♦♦♦

Denison Seeking Partner To Cure Financial Problems

Denison Mines is seeking to amalgamate with another company as one possible solution to its current financial problems. Recently-hired president Bill James indicated that a hard-rock mining company could be a candidate since such a company could benefit from Denison's unused depletion allowances, currently totalling over C$100 million.

Germany's New Coalition Government Agrees To Revise Atomic Act

The new coalition government of Germany has agreed to a proposal to substantially change the German Atomic Act. Among the changes proposed: the promotion of the peaceful use of nuclear energy would no longer be a mandate of the act; plant operators will no longer be compensated for required safety-related backfits; construction and management of nuclear waste storage facilities would be turned over to private industry; the mandated bias towards reprocessing and away from direct disposal of spent fuel would be eliminated.

Industry officials quickly expressed displeasure with the proposed revisions to the Act, and assured lawsuits would be filed if the Act is revised as proposed by the coalition government.

♦♦♦

Spain's ENUSA Begins Construction of Uranium Concentrates Plant

Empresa Nacional del Uranio SA (ENUSA), the Spanish nuclear fuel and fuel fabrication company, has begun construction of a 950-ton per year uranium concentrates plant. The plant, which is scheduled for completion in three years, is located in the Salamanca province. Upon completion, the plant will be able to process all of Spain's needs for uranium concentrates.

Korea Electric Power Corp. Adds Plans For 5 Reactors, Including Candu

Korea Electric Power Corp. (Kepco) has plans to invest US$61.2 billion during this decade for the construction of 39 new power stations. Five nuclear units are included in the station plans. The completion of the five units would give South Korea a total of 14 nuclear power plants, which will provide nearly one third of the country's electricity by the year 2001.

At least one of the new nuclear units will be a Candu-type reactor as KEPCO recently signed a contract with Atomic Energy of Canada Limited (AECL) to purchase a 680-MWe reactor. This reactor, Wolsong-2, will be South Korea's second Candu reactor, an updated version of the Wolsong-1 Candu reactor. Construction on the US$1.2 billion project, located on South Korea's southeast coast, is scheduled to begin in 1992 with completion in 1997. South Korea will have the primary responsibility for construction management and project supervision.

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RECENT DEVELOPMENTS

Czech Bohunice-1 & -2 VVERs To Remain In Operation Through 1991

The Czechoslovakian government decided in January to continue operating the old Soviet-designed VVERs (model 230s) at the Bohunice site at least through 1991, but only if certain safety-related backfits can be accomplished. The entire backfit program is planned to take two years, and cost over US$100 million. The first backfits will improve emergency and fire-protection systems.

Completion of the entire backfit program may gain the Bohunice-1 and -2 units approval to operate through 1995. After that time, Czechoslovakia plans for its safety regulations to match the level of Western Europe, and it is unlikely these Bohunice VVERs could be brought into compliance with these even stricter regulations.

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Germany Closes Down Last of Greifswald VVERs

The last operating unit of the four old-style (model 230) Soviet-designed VVERs at the Greifswald station in eastern Germany was closed down at the end of 1990. The unit, built in 1973, was closed because it could not meet the stricter safety standards of the unified Germany. The other three Greifswald VVERs were shutdown earlier in 1990 for the same safety reasons, however closure of the last unit was delayed until completion of a substitute oil-powered generating station.

Sweden's Political Parties Finally Agree On Nuclear Phaseout Plans

On January 15, Sweden's three major political parties—Social Democrat, Liberal and Center—announced they had reached an agreement on a plan for the phasing out of nuclear power in their country. However, the parties released few details of the agreement, leaving unexplained how the many political and legal issues hindering the phaseout plan were resolved.

The agreement calls for an investment of nearly US$1 billion in development of renewable energy sources and conservation measures. Also, CO_2 emissions will not be allowed to increase above 1988 levels. Further details should be released soon, particularly confirmation of whether the phaseout plan's initiation date of 1995 and completion date of 2010 (the latter mandated by parliament in 1980) are still considered viable, or whether this scheduling must be delayed.

The agreement is not yet policy, but proposed laws regarding the phaseout plans should have a strong chance of passage, since the parties have apparently worked out their major differences.

ABB Forms Italian Consortium

ABB Atom of Sweden, with Italy's Ansaldo, and Fiat Componenti e Implanti (a Fiat subsidiary) are forming a new consortium, Consorzio Pius. The consortium will develop a design, based on ABB's PIUS LWR, that meets Italian licensing requirements, thereby positioning the new firm for a reconsideration of nuclear power by the Italian government. ABB will own 60% of Consorzio Pius, while Ansaldo will own 25%, and Fiat, through its subsidiary, will own the remaining 15%.

◆◆◆

Japanese Pro-Nuclear Governor Reelected, Fuel Cycle Plant Likely to Proceed

On February 3, 1991, incumbent governor Masaya Kitamura was reelected to his fourth term in the Aomori Prefecture. The pro-nuclear governor received 44% of the votes in defeating his two anti-nuclear opponents. The Aomori Prefecture includes the village of Rokkasho, the construction site of Japan's first major fuel cycle facility. Plans for the site, with projected costs of over US$9 billion, include a uranium enrichment plant, low-level waste storage, and a plutonium-extraction plant, though the latter has yet to receive governmental construction approval. The election was an important hurdle for the Japanese nuclear industry as completion of the plant figures prominently in the self-sufficiency goals of Japan's long-range nuclear energy plans.

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COMMENTARY

When Will Nuclear Power Return?

This essay by J. Robert Wolcott, Chairman of NUEXCO's International Advisory Committee and former chairman of NUEXCO, comments on when nuclear power will be ready to return in the United States. Right now, neither the country as a whole, nor the nuclear industry, is prepared for a renewal. Mr. Wolcott discusses what steps by the industry are necessary to lead to a renewal of nuclear power in the USA.

After a negative trend lasting 15 years, the United States' nuclear program appears to have bottomed and taken a slight upward turn. Actual and potential electrical power shortages; an ever increasing variety of electrical power applications; fossil fuel pollution; Middle East upheavals; and nuclear technology advancements are largely responsible. Future generations will not indefinitely forego the use of the inexhaustible, clean, energy source that nuclear power provides, so eventually it must return to commercial service. But when? Will it be in the foreseeable future? The answer depends largely upon the answers to these three questions:

1. When will the need for electrical power in the United States be such that nuclear power becomes unavoidable?
2. When will nuclear power offerings be available from suppliers in the form that the market desires, and with the required verifications?
3. Assuming 1 and 2 above are positive—that is, nuclear power is available and its use is a necessity— when will social and political conditions permit deployment?

When Will Nuclear Power Be Needed in the United States?

Electrical power demand in the United States will continue to grow. The consensus is that growth will be approximately 2.5% per year. This growth rate translates into a need to have 150 to 200 additional large power plants operating by the turn of the century. Construction for most of these has not yet started.

If a combination of coal, oil, or natural gas was suitable in all respects, nuclear power construction might be delayed indefinitely. However, economics, long-term availability, and pollution do not favor expanded use of fossil fuels in the long term, or even the intermediate term. A substitute for nuclear power is not on the horizon.

Despite shortages which already exist, I do not believe all of the 150 to 200 plants needed by the end of the century will be built. Too many obstacles to power plants of all types remain. Consequently, electrical power shortages will become more common and severe, and public pressure for a solution will increase. A more favorable political attitude would be expected, but that does not necessarily mean nuclear power will suddenly expand. Nuclear power is needed today, but cannot expand because preparations are not sufficient to meet the need. The most important immediate need, therefore, is to proceed with preparations required for nuclear's expanded use.

First Era Background

Before looking ahead to a "Third Era" (the future) of nuclear power, I think it is worthwhile to recall how nuclear power evolved in the "First Era" (initial expansion) and the "Second Era" (cutbacks and cancellations), for there are lessons to be learned and pitfalls to be avoided.

Two United States pioneering plants, Dresden One by General Electric, and Yankee Electric by Westinghouse, provided the basis for light-water reactors throughout the world. Those projects were begun around 1955, and were successfully completed and placed in operation by 1960. Each had a capacity of approximately 200 MWe. Warranties were met. Costs were near estimates. Safety, reliability, and technical feasibility were demonstrated.

After the demonstration of successful results, orders of larger plants followed. Much of the buying was motivated by environmental advantages (coal was dirty) and an uneasiness about long-term commitments to oil (largely Middle East problems). What began as a modest rate of buying later developed into a surge. In the late 1960s and early 1970s, orders for new nuclear plants sometimes

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exceeded a rate of 20 plants per year, in sizes from 600 to 1,200 megawatts. The attraction to nuclear power continued for a time. By the early 1970s, two hundred plants were ordered or planned.

But due largely to much higher oil prices, an unexpected downturn in the economy occurred. That downturn, and higher energy costs in general, reduced the electrical growth rate. The projected growth rate of 7 percent, which was the basis for new construction plans, dropped to between 3 and 4 percent.

The Second Era

The revised projections substantially reduced new plant requirements. Coal, nuclear, and other types of power generating plants were cancelled to bring future building into line with the revised projections. Ordering of all new capacity stalled for a time. Nuclear never recovered due largely to the Three Mile Island (TMI) accident in 1979. Emphasis shifted to coal.

As the past may provide a guide to the future, several observations are relevant. First, buying did not begin until demonstration plants operated successfully. Had there not been demonstration plants, it is unlikely that buying would have occurred at all. Second, buying was motivated, even then, by considerations not unlike those the nation faces now. Coal, oil, and gas supplies were not considered sufficient, nor environmentally sound. Third, once buying began, it escalated too rapidly, with the result that suppliers, users, and regulators were overloaded.

Changes for the Third Era

The First and Second Eras of nuclear power spanned 35 years, and included some great successes and great failures. The fact that nuclear has come to produce 20% of the nations' power in a relatively short time is an important success. On the other hand, the fact that confidence was lost and new orders stopped in the mid-1970s is an important failure. The challenge for the future is to build upon successes of the past, while avoiding its failures. A number of new issues and situations must be taken into account.

First, it would be easy, but misleading, to assume that termination of orders in the 1970s was an unfortunate discontinuity in the normal progress of the industry's development, and that once over, the industry could pick up where it left off, as though the discontinuity had never occurred. Too much has changed for that. Virtually a whole new start must be made.

Second, the people who now manage nuclear suppliers, utilities, various government bodies, and others in control today, were not in positions of policy control in the 1950s. Most, in fact, had not even reached middle management at that time. The experience upon which they now draw, and which influences their thinking, has grown mainly out of the Second Era—an era of frustrating delays, cost problems, environmental attacks, public resistance, regulatory conflict and feeble government help. I think they feel—justifiably—that it is unwise for them to make commitments in advance of what the government clearly and effectively supports. In fact, a desirable, and probably essential condition is that public pressure be applied on government to act and for government to then press industry.

The challenge for the future is to build upon successes of the past, while avoiding its failures.

First, a new start must be made.

Second, public pressure must be applied on the government to act and the government to then press industry.

Third, standardization must be achieved.

It is not likely to happen the other way around, where industry commitment leads as it did in the 1950s. Given past experience and current attitudes, it would be a rare board of directors, top management, and group of investors

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that would authorize a nuclear plant purchase until reasonable assurances are available that the debacles of the first era will not repeated.

Third, standardization must be achieved. The solutions to many problems, including industry organization, cost control, schedule control, system design, and licensing depend upon the realization of standardization. Basic technical knowledge available for design is at least adequate. Technical feasibility of light-water reactors, in particular, is well established. Current knowledge is a thousand times or more greater than that which existed in the 1950s.

Deployment of the next era of nuclear power plants will only take place when and if the benefits, including cost and environmental benefits, are sufficient to justify use. Nuclear should not be, and will not be, chosen simply because it is nuclear.

Despite this wealth of knowledge, achieving standardization will be difficult in the United States system. Success will not be automatic simply because standardization is policy. Project cycles are long, and long cycles are subject to continual pressures for change. The United States has many users, supplier participants, and regulatory bodies. The eight to ten years required from the start to finish allows for many influences to work against the status quo. New ideas are offered. Experience on one project suggests change on the next. Safety proposals are especially difficult, as even small modifications cannot be rejected out of hand. No one wants to be on the wrong side of safety issues.

Cost improvement suggestions, as well, can be difficult and less easily rejected than it may appear. For example, a $10,000 investment in a modest design change may promise a $100,000 savings in construction. That change repeated on ten projects would save $1,000,000. A ten thousand percent return is not easily ignored, especially with prudency reviews lurking in the background. Varying site conditions and engineered equipment (such as pumps) also open design to modification. And once changes begin for whatever reason, the door is opened to a chain of regulatory modifications.

All that, of course, does not lessen the merits of standardization. It does, however, suggest that buyers will look for solid evidence that standardization is actually achieved before placing a firm order.

Fourth is the demand for increased safety. The public wants more. There can be no persuasive argument for less. At one time suppliers and users met what was accepted as a standard of safety and focused competition on economics and reliability. Today, a nuclear system must be economic, all things considered, but superior safety will be much more influential. In short, safety competition takes precedence over economic competition.

Yet safety competition adds uncertainty. Suppliers and users face choices which cannot be avoided. The most complete advanced designs are being prepared in the United States and constructed in South Korea and Japan. They are available for the United States. However, later concepts believed to be superior from a safety standpoint (called inherently safe and passively safe concepts) are also in development and design, though less advanced. The latter will not be ready for commercial deployment as soon as the former.

However, their unique, and perceived safety advantages, force decisions. How will suppliers and users who risk substantial investments, ultimately decide? Should they place their bets on the model most available, or should they take the longer route with the safer, but as yet unproven models? Or some combination? What are the risks if they proceed with the more proven, but less safe designs and are challenged by consumer and environmental advocates? Are they willing to defend the choice, knowing that they may have to argue economics and schedule ahead of safety? What is the risk that public pressure may force a change—that is, abandoning an early choice in favor of a later, safer, concept? We know that the safer approach, even if based only on theory, usually wins.

The Need for Two Stages in the Third Era

To accommodate the conditions outlined, I believe we must think in terms of progressing through two stages in

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the third era: a demonstration stage and a deployment stage. More specifically, I view these stages as follows:

The *Demonstration Stage* should lay an extensive, solid, and complete foundation upon which to build. It must entail designing, constructing, and thoroughly testing standardized, licensed, economically competitive, even safer, full-scale nuclear power plants. An eight to ten year cycle will be required. A start is underway; the Westinghouse AP-600 pressurized water reactor and the General Electric SBWR (Simplified Boiling Water Reactor) are being designed.

The *Deployment Stage* must build on demonstration plant results. Deployment will only take place when and if the benefits, including cost and environmental benefits, are sufficient to justify use. Nuclear should not be, and will not be, chosen simply because it is nuclear. (Although some will resist nuclear simply because it is nuclear.)

What does this two-stage approach say about the timing of nuclear renewal? If deployment must await demonstration stage results, and the demonstration stage will require eight to ten years, then a renewal might be practical around the turn of the century. Perhaps a few bold users will order earlier assuming success of demonstration plant performance, but they are likely to be few in number and commitments may be only contingent.

On the other hand, once a successful demonstration stage has been completed, ordering may resume with confidence. I do not see a surge of orders as occurred in the 1960s. I do foresee a more careful buildup consistent with suppliers, users, and regulator's capabilities.

Critical Demonstration Stage Considerations

Because a demonstration program schedule will determine when nuclear power has the capability to provide a significant share of the 20 to 30 new plants needed each year, it is important to mention some considerations affecting the timing, effectiveness, and quality of such a program.

The Need For Competition

Competition between demonstration plants and their suppliers and users is essential. Competitive results should include safety, economics, and reliability. At least two, and preferably three or four, projects should proceed on similar schedules.

A single national design with competition limited to construction, as has been suggested by some, would be inadequate "semi-competition". Construction costs, safety, reliability and operability start in design. Many incentives will be lost without comprehensive competition. Moreover, a national project, as a single design would undoubtedly become, would most likely end up with the government in control. The government record for successful energy projects is notoriously bad, and if that should happen in this case, nuclear power may be set back another decade or two.

Government Support

Government support is required in some form. The best form would be for the government to assume responsibility for cost increases that were caused by government action which occurred after some agreed point in time. Private investors could stand for costs within their control, but the worrisome part of a nuclear project are costs caused by decisions outside their control.

Anti-nuclear Opposition

The public is ambivalent about nuclear power. A solid majority expect it to play an important role in the future, but few favor a plant in their community. The problem, nevertheless, is not so much with the majority as with anti-nuclear forces whose influence is far beyond what their numbers justify in a democratic system. Thus far, Congress, and to some extent the courts, have not shown a willingness to confront these special interests. That will have to change.

Organization

The next nuclear plant purchase will likely be by investors formed as an independent power producer. The objective may be both to produce electrical power and to serve as a demonstration plant. Comparable organizations are being discussed in the industry, but one has not yet coalesced. The supplier side also needs reorganization to provide fixed-price turnkey plants, much as was done in the first era in the United States and is now done by other suppliers in France and Japan.

Siting

Selection of sites for demonstration reactors is critical, for every year of delay experienced in the demonstration phase will mean a year of delay for the beginning of the deployment stage. The urgency for nuclear use will continue to increase each year.

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Wide public acceptance remains a problem, but attitudes vary by communities. For example, I believe it would be possible to build several demonstration plants in Idaho near the present Idaho National Engineering Laboratory (INEL) site with little, if any, resistance. In fact, the opposite is probable, for the community would likely welcome projects of that type. Community leaders, the governor, the legislature and other leaders are encouraging this type of activity.

Nuclear Waste

Nuclear waste is not directly a part of a demonstration plant program discussed herein, but is relevant and important to it. The waste problem needs to be publicly perceived as "solved", or on its way to solution by the time the demonstration program is complete.

Nuclear power is needed today, but cannot expand because preparations are not sufficient to meet the need.

Countries which have taken action to store and handle waste, even though approaches differ, do not have the so-called waste problem of the United States and other countries, which have muddled waste programs. Sweden and Finland store spent fuel in deep underground facilities. France and the United Kingdom reprocess and store glassified waste. In these countries the waste issue is minor or non-existent.

The United States' waste problem is that little gets done, and when projects eventually do begin, they are allowed to be blocked, as with the New Mexico and Nevada facilities. With a well-managed waste program, the waste problem could virtually disappear by the turn of the century, when the solution is most needed.

Summary and Conclusion

Let's return to the questions posed at the outset: the need for electrical power; the readiness of the industry; and the evolution of social and political attitudes. What can we conclude?

There is little question that the United States will need nuclear power. The sooner it is available the better, for electricity use is growing more rapidly than generating capacity. For these reasons, some experts expect growth in the industry in about five years. However, I believe we are not prepared to proceed on that schedule—not because the need will not exist, but because preparations will require eight to ten years. Therefore, the critical program on which to concentrate is a new generation of demonstration plants as a foundation for the future. Every year of delay for these plants will mean a year of delay in true expansion.

The social and political climate ten years hence is, of course, difficult to predict. But insofar as nuclear power is concerned, recent improvements are evident and there is reason to believe those will continue. Public and government support appears adequate now to support a demonstration program of the type described. Even many of those unenthusiastic about nuclear power are reluctant to forego the option—the future is too uncertain. My belief, all things considered, is that the outlines of a demonstration program will take form in the next year or two and will proceed to completion, though not entirely without difficulty. I estimate a renewal—that is, commercial expansion—will begin in ten years and grow steadily after that.

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URANIUM INDUSTRY OF EASTERN GERMANY

For more than forty years, the former German Democratic Republic (GDR) was the most important uranium producer of the former Eastern Bloc countries. Between 1946 and 1990, it produced about 570 million pounds equivalent U_3O_8, which greatly exceeds combined western Europe uranium production and equals two-thirds of US uranium production over the same period. However, the political changes in Eastern Europe and the reunification of Germany on October 3, 1990 have changed the situation. Strict West German safety and environmental regulations, combined with the introduction of the DM (West German Deutsche Mark) and other factors such as cancellation of the Soviet-East German uranium trade agreement, have put pronounced economic pressure on uranium mining in eastern Germany. SDAG Wismut, the exclusive uranium producer, has little choice other than to close its uranium mines in the near future.

Background & Electrical Power Generation

The former GDR encompassed a surface area of about 108 thousand square kilometers (40,300 square miles), which is about the size of the US State of Tennessee (109,000 km^2). The GDR's 16.4 million inhabitants now comprise about 20% of the population of unified Germany (78 million). GDR electricity generation totalled 115 billion kWh in 1989, approximately 83% of which was generated at lignite-fueled power plants (installed capacity 13,260 MWe), and about 10% was from nuclear power plants.

The GDR mined 320 million tonnes of lignite in 1989 and 1990, placing the GDR as the largest lignite producer in the world. But lignite's high sulfur content and dust generation resulted in an extremely high pollution rate. GDR lignite-power stations emitted about 310 kg of sulfuric acid per person per year, compared to 30 kg per person in western Germany. Lignite dust development was about 2.2 million tonnes per year in East Germany, compared to 0.56 million tonnes per year in West Germany.

The GDR's nuclear power program had plans to construct two Soviet-designed commercial nuclear power stations with a total capacity of 7,500 MWe by the end of this century. The first station at Lubmin near Greifswald (**Figure 1**), was designed for eight reactors of 440 MWe each. At the end of 1989, Greifswald units 1–5 were operating and three additional reactors were under construction. In early 1990, units 2 and 3 were shut down because they did not meet West German safety standards. All of the other Greifswald units were shut down later that same year.

A second station at Stendal on the Elbe river was to include four reactors of 1000 MWe each. Two units were under construction in 1990 and the other two were in the planning stage. In spite of the urgent need to replace the polluting lignite-fueled power plants, completion of the nuclear plants as originally designed is now unlikely. The reactors must be redesigned if they are to comply with rigid western safety standards. Concerns of active antinuclear groups in Germany may also affect completion of the units.

Uranium Mining Industry

Uranium minerals were noticed in the mines of the Erzgebirge (Ore Mountains) of Saxony, long before they were chemically identified. Pitchblende from the Erzgebirge was mentioned as early as 1565, and other accounts of pitchblende date back to the year 1727. Uranium mining started in the Erzgebirge early in the 19th century. Approximately 110 tonnes of uranium were produced between 1825 and 1898.

In the immediate post-WWII period, uranium was produced only for military purposes. Ore was mined and milled in the GDR and the concentrates were shipped to the Soviet Union. The GDR then had to buy back the uranium it needed to fuel its nuclear power plants.

Mining methods in the 1940s and 1950s were old-fashioned and primitive, and working conditions were harsh and unhealthy. Some of the labor utilized during this period were prisoners or inmates of forced-labor camps. But since that time, mining techniques and safety standards have been improved and are now comparable to those in western countries.

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Figure 1
EASTERN GERMANY

Legend To Figure 1

- Uranium District
- Uranium Mill - Seelingstädt
- Nuclear Waste Disposal Site - Morsleben
- ❶ Greifswald Nuclear Station
- ❷ Stendal Nuclear Station
- ❸ Rheinsberg (70MW training reactor)
- ❹ Rossendorf Nuclear Research Ctr.

Up to 1956, all uranium mining in the former GDR was directed and administered by a Soviet enterprise. On January 1, 1956, the enterprise was transformed into a Soviet/German Joint-Stock Company, named SDAG Wismut, with headquarters in the city of Karl Marx-Stadt, now called Chemnitz. Shareholders of SDAG Wismut were the East German Ministry of Economics and the Ministry of Atom-Technique and Atom-Industry of the USSR. Both parties held 50% of the total capital of 4.5 billion GDR marks.

The basis for the joint operation was a contract between the Soviet and East German governments through the year 2000 for "Exploration, Mining and Treatment of Uranium Ores." Financing, annual production rates, deliveries, and prices were set out in five-year plans. The most recent extension was agreed upon in 1986 for the period through December 31, 1990. Due to the recent political changes, the Soviet Union did not sign a further extension.

The name Wismut, which means bismuth, was selected to camouflage the actual purpose of the enterprise, which was to mine uranium. All activities, production rates, manpower, and other information were declared top secret. Even within each level and among individuals within the company, all transmission of information of any kind was prohibited except to a listed superior. In fact, until two or three years ago, Wismut employees were prohibited from even using the term uranium. Instead, uranium could only be referred to as "metal." The security measures in East Germany were so tight and effective that very little information was known in the west, and that information was mostly speculative. This was in contrast to other COMECON countries, where at least some information on uranium ventures, deposits, and production reached the west.

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SDAG Wismut was like a state within the State. Besides uranium mining, the company had its own branches or subsidiary companies that provided all auxiliary services needed for the uranium mining, including manufacturing of required machinery, equipment, and instruments, housing construction, and research facilities. Wismut had its own medicare system and hospitals, and even its own police/security department. Until this past year, the director general was always a Soviet national, most recently Valentin Nasarkin. He has been succeeded by the first German director, Dr. Richter.

Wismut had an estimated workforce of more than 100,000 people in the 1950s. In 1990, Wismut employed about 39,000, nearly 20,000 of which worked in the mining branch.

Economics of Uranium Mining

Since 1980, uranium production costs have averaged between 200 and 250 GDR-Mark/kgU (about $58 per pound U_3O_8 using the offical 1:1 GDR-Mark to Deutsche Mark exchange rate). Uranium mining was expensive due to labor intensity, the necessity of selective mining, decreasing ore grades, reserve depletion, and increasing depth. The introduction of the DM in July 1990 imposed an additional burden on production economics, pushing recovery costs upwards even further. Under these economic conditions, probably very few, if any, of the uranium mines in eastern Germany will survive. The government is considering using some of the deep mines in the Erzgebirge (2000 meters deep) for storage of radioactive waste.

Environmental Impact

Over the years, not much effort has been directed towards reclamation and recultivation of mine dumps and mill and tailings ponds. Clean-up costs are estimated at US$ 3–4 billion.

Uranium Mining and Milling

Wismut operated about 50 mines during the 1960s and 1970s. In peak years, production exceeded 18 million pounds equivalent U_3O_8 per year. In 1990, seven mines were still active in four districts (**Figures 1 and 2**):

- Aue District, Saxony—Niederschlema-Alberode deposit;
- Pöhla District, Saxony—Tellerhäuser deposit;
- Königstein/Elbsandsteingebirge District, Saxony;
- Gera-Ronneburg District, Thuringia.

Conventional underground mining methods are used in all areas except Königstein, where chamber leaching techniques have replaced conventional methods. 1989 production totalled six million pounds equivalent U_3O_8.

Uranium ore processing currently takes place at Seelingstädt, about 10 km southeast of Gera, Thuringia. The mill began operation in 1960, and has a treatment capacity of 3.0 to 3.2 million tonnes ore per year (eight million pounds equivalent U_3O_8). Ore has been treated by both alkaline and acid leaching, but since 1990, only alkaline-leaching (with caustic soda) has been applied. Tailings are deposited in the former open pits at Culmitzsch and Sorge-Settendorf. In mid-1990, 1,600 people were employed at the Seelingstädt mill, about 900 of them directly involved in uranium production. Wismut also operated the Crossen mill near Aue, Saxony until it was closed in January 1990. In the 1960s, the mill processed 50 percent of East German uranium production.

URANIUM DEPOSITS ACTIVE IN 1990

Niederschlema-Alberode Deposit; Aue District

The Niederschlema-Alberode deposit, discovered in the late 1940s, is located north of Aue in the western Erzgebirge, 30 km southwest of Chemnitz. It is the main deposit in the Aue-Schneeberg uranium district. Total original resources are estimated at 230 million pounds equivalent U_3O_8, of which 190 million pounds had been mined by the end of 1989. These resources make Niederschlema-Albelode one of the largest, if not the largest, vein uranium deposits in the world. The mining grade varies, but a cut-off grade of 0.03% U is used and ore is blended to an average of 0.4% U in order to meet the processing standard at the Seelingstädt mill.

Geology and Mineralization

Uranium ores of the Niederschlema-Alberode deposit occur discontinuously in a series of steeply-dipping veins within an elongated area up to 2.5 km long, 400 to 500 meters wide, and in excess of 2000 meters deep.

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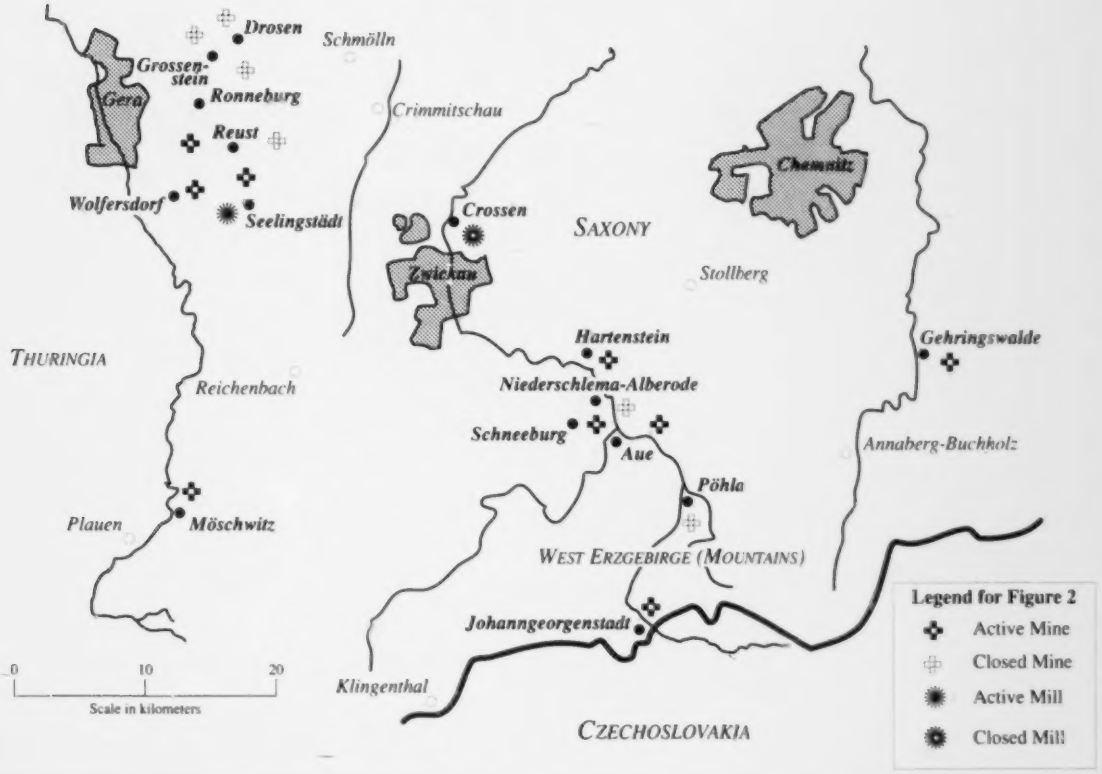
Figure 2
Uranium Facilities in the State of Saxony



Individual veins average 1.3 meters in width, with rare veins as wide as 10 meters. Mineralization is of polymetallic vein-type. Country rocks are folded late-Proterozoic to early-Cambrian schists and gneisses with imbricated Silurian-Devonian metasediments. Granitic plutons and a variety of igneous dikes intruded into these sequences during the Hercynian Orogeny. A contact–metamorphic halo surrounds the granites, and all ore-bearing veins occur within this aureole. Approximately one thousand mineralized veins have been identified. Principal uranium minerals are pitchblende and coffinite, which are also associated with Ag, Co, Ni, and Bi minerals. Gangue minerals are predominantly quartz and carbonates.

Mining

The underground mine has more than 30 surface and internal shafts, with the deepest level reaching 1,880 meters below the surface. Mining levels are usually 30 meters apart, though some are 45 meters apart. The mining methods used are longwall (shrinkage) stoping and, at depth, a modified shortwall cut-and-fill method progressing upward. Minimum mining width is 0.8 meters. The high rock temperatures of 65°C at depth necessitate cooling systems which reduce air temperatures to 21–27°C. The mining blocks are served by an extensive rail haulage system. The hoisted ore is trucked 10 km to Hartenstein where it is blended to an average grade of 0.4% U, then shipped by rail to the mill at Seelingstädt (40 km). Current production is about 100 thousand tonnes of ore per year from a workforce of 4,500 employees.

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Tellerhäuser Deposit; Pöhla District

The Tellerhäuser deposit, discovered in 1973, is located about 20 km southeast of Aue, in the central-western Erzgebirge. Total original resources amounted to 17 million pounds equivalent U_3O_8, of which approximately three million pounds have already been mined. The mining grade varies, but a cut-off grade of 0.03w/o U is used and ore is blended to an average of 0.4w/o U in order to match the processing standard of the Seelingstädt mill.

Several tin and tungsten deposits (Hämmerlein, Tellerhäuser, and Globenstein) occur adjacent to the uranium deposit. Grades range from 0.1 to 0.63w/o Sn and locally up to 0.45w/o WO_3, and contain a total of almost 200 thousand tonnes Sn, about 40 thousand tonnes W, as well as other metals.

Geology and Mineralization

Uranium ore occurs intermittently in veins within a triangular area 1,500 meters long and up to 1000 meters wide. Almost 20 uranium-mineralized veins have been identified. Individual veins can be 500 to 1000 meters long and as much as 1.5–2.5 meters thick, but may be split into several branches. The veins extend over a vertical interval of 15 to 60 meters. Mineralization is of polymetallic vein-type. Country rocks are mica schists and two-mica gneisses of the late-Proterozoic to early-Cambrian Joachimsthal Series. Cambrian and Ordovician metasediments rest on the series. Hercynian granite occurs at a depth of 700 to 850 meters. Uranium mineralization is concentrated where the veins cut carbon and pyrite-bearing schists in the contact-metamorphic aureole (or skarn) surrounding the granite. Pitchblende and coffinite are the principal uranium minerals, and are commonly associated with Ag, Co, Ni, and Sn minerals, and quartz and carbonates.

Mining

Access to the Pöhla-Tellerhäuser uranium deposit is by a 6 km long drift at a level 600 meters above sea level from which two internal shafts extend into the deposit. Main levels are 60 meters apart (between 85 and 300 meters above sea level) with intermediate levels about 30 meters apart. Mining is by longwall (shrinkage) stoping, and ore is hauled underground by rail. Further treatment of the ore is similar to the Niederschlema-Albelode mine. Some 800 people work in the Pöhla-Tellerhäuser mine.

Königstein/Elbsandsteingebirge District

The district is located about 20 km southeast of Dresden. Original resources are estimated at 62 million pounds equivalent U_3O_8. Several ore bodies have been mined, including Langenhennersdorf and Leopoldishain near Königstein. Mining grades vary between 0.08 and 0.15w/o U. Since the district's discovery in 1961, 45 million pounds have been recovered, and the deposits will soon be exhausted.

Geology and Mineralization

Uranium mineralization is of sandstone-type and is concentrated in rollfront-type ore bodies. Host rocks are continental clastic sediments of Cenomanian age deposited in a basin surrounded by granitic and metasedimentary rocks of the eastern Erzgebirge. The geology resembles to a large extent that of the North Bohemian Cretaceous Basin, which hosts large sandstone-type uranium deposits such as Hamr and Straz in Czechoslovakia (see Monthly Report #265, September 1990, pp. 38–39). In effect, the Königstein district is a northern extension of the North Bohemian Basin.

Mining

Conventional underground mining started in 1967. The mines were about 200 meters deep and were served by several shafts. Testing of leaching techniques has been conducted since the 1960s. Since 1983, only underground leaching techniques (chamber leaching) have been applied and all conventional mining abandoned. (See the February 1989 Monthly Report, #246 pp. 22-29, for a description of minewater uranium recovery methods.) Conventional mining produced 37 million pounds equivalent U_3O_8 and leaching over eight million pounds. Conventional mining grades, at a cut-off grade of 0.03w/o U, were 0.13w/o U from 1967 to 1971, 0.14w/o U from 1971 to 1976, and thereafter 0.1w/o U. Leaching was applied to ore grading up to 0.079w/o, at a cut-off grade of 0.02w/o U. Leaching capacity is 800 thousand to one million pounds equivalent U_3O_8 per year. The workforce in the Königstein district numbers nearly 1,900 employees.

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Gera-Ronneburg District, Thuringia

The Gera-Ronneburg uranium district was discovered in 1950, and includes several deposits located around the town of Ronneburg. Original resources are estimated at about 520 million pounds equivalent U_3O_8, of which 240 million pounds has been mined. Mining grades are 0.08 to 0.095% U at a cut–off grade of 0.03% U. Ore is shipped up to 15 km by rail to the Seelingstädt mill.

Geology and Mineralization

Several uranium deposits occur in an area 25 km long and 8 to 15 km wide. The area covers part of a large horst structure composed of Paleozoic sediments intruded by dikes and sills that range lithologically from diabase to porphyrite. The sediments are intensely folded and faulted. A regional fault, the Crimmitschauer Lineament, which vertically displaces the sediments by up to 150 meters, constitutes the NE-boundary of the district.

Mineralization is of strata-controlled, structure-bound (stock-work) type. Uranium minerals fill, coat and impregnate minifractures (joints, cleavages), which are arranged in a stockwork-like pattern within distinct lithologic units. These lithologic units, namely Ordovician shales and limestones, and Silurian carbonaceous-pyritiferous shales, are all cut by diabase. The mineralized sediments dip northward, and crop out in the southern part of the district. Ore is found from the surface down to 300 meters. Ore bodies at the northern end of the district are in excess of 1,000 meters deep.

Figure 3. Gera-Ronneburg District. The 940-meter deep shaft at the Drosen mine.

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Mineralized minifractures are less than 1 mm to 1 cm wide. They form irregular shaped stockwork-type ore bodies 20 to 500 meters long, vary in width from a few meters to few hundred meters, and vary in thickness from less than two meters to 120 meters. In-situ U content ranges from 0.075 to 0.15w/o U, at a cut-off grade of 0.03w/o U. Some locally concentrated ore bodies (termed K–Erz) grade as high as 0.2 to 0.5w/o U. Host rocks are altered by silicification, chloritization and dolomitization. A bleached halo, a few centimeters wide, often surrounds mineralized structures.

Principal uranium minerals are collomorphous pitchblende, minor coffinite and sooty pitchblende. They are associated with Fe, Pb, Zn and Cu sulfides, which together constitute less than 1% of the ore. Trace amounts of Co-Ni arsenides also occur. Ore-related gangue minerals are predominantly carbonates, with barite and clay minerals. The carbonates amount to 5% or more of the ore.

Mining

Four former deposits were mined by open pits to a depth of 250 meters. All other deposits have been exploited by underground workings, served by about 25 shafts.

Presently four underground mines are in operation:

Mine	Start	Capacity (mill. tonnes/yr)	Mining grade (w/o U)	Mining depth (meters)
Drosen	1982	0.8-1.2	0.072-0.08	720
Paitsdorf	1963	1.0	0.078-0.085	525
Schmirchau	1950	0.8	0.077	570
Beerwalde	1974	0.5	0.074-0.083	600

Drosen is the largest mine, and operates in an oval area 4 km long and 1.5 km wide. Ore occurs at a depth between 540 and 1040 meters below surface. In-situ ore grade averages 0.085w/o U. Mining losses are approximately 20%. Four 940-meter deep shafts provide access to the ore. The deepest present mining is at a depth of 720 meters. The mining method is sublevel stoping with downward extraction of slices four meters thick. Productivity is about 6 cubic meters per man per shift (6 hour shift). One of the main problems encountered at the mine is smoldering (low-temperature burning), which is caused by the reactions of pyrite and organic matter when exposed to oxygen by mining. Stoped intervals are refilled with self-solidifying fill introduced through boreholes. Fill material is lean concrete with lignite filter-ash used as a binder. Hardening takes an average of 14 days.

Conclusion

The productivities seen in these mines (Aue: 250 pounds U_3O_8 per man-year; Königstein/Elbsandsteingebirge: 500 pounds U_3O_8 per man-year) are very low by western standards. The Panel and Quirke mines of Canada's Elliot Lake district, which were closed in 1990 because of high costs, had productivities in the range of 3,000 pounds U_3O_8 per man-year. If the mines of Wismut cannot match western mines in terms of manpower productivity, they are unlikely to be competitive in the world market in the long term.

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1990 Exploration and Development in North America

The North American continent is the largest uranium producing and exporting area in the world. Despite the effects of record low market prices, uranium exploration continues, as evidenced by some exploration and definition drilling, and assessment drilling.

Canada

CAMECO, operator of Key Lake, the largest uranium production complex in the world, has an ongoing, but limited, exploration program. In 1990, this program consisted of less than 50 holes, but proved a 200 million pound, high-grade U_3O_8 deposit at McArthur River in the Athabasca Basin of northern Saskatchewan. This deposit is only 40 miles northeast of the existing Key Lake mill complex and will provide the resources for processing at Key Lake well into the 21st Century.

Further north, Denison Mines Ltd. completed its test mining program at the Midwest project during 1989. During 1990, Denison removed its equipment from the site and allowed the mine to flood. The test mining was a technical success, with the extraction accomplished using large diameter holes drilled from mine workings just above the deposit. The economic implications of the tests are still being studied and have not yet been announced. Denison is currently going through a corporate reorganization, which may delay any further activities at the project.

In the same area, Minatco, a subsidiary of TOTAL of France, acquired full ownership of the McClean Lake prospect, now renamed the Wolly Project. Feasibility work has been started and permitting activity could start this year. Newly-defined zones north and east of the main McClean Lake occurrence will likely be mined first, using open pit techniques, while the 160-meter-deep McClean deposit is considered an underground site.

A few hundred miles to the northeast, near the west shore of Hudson Bay, is the Thelon Basin, which is very similar geologically to the Athabasca Basin. Several firms were active in the district to some degree in 1990; Urangesellschaft (UG) of Germany, PNC Exploration (Canada) Co. Ltd. (Japanese parent company), and Power Resources Inc. (formerly CEGB Exploration, Inc. of the United Kingdom). The most active company in the Thelon Basin has been UG. UG plans to exploit the Kiggavik Project's 45 million pounds of reserves from two open pits over a period of eleven years. But this project has several factors slowing its progress, including poor market conditions and Native American land claims in the area. UG has recently withdrawn its permit application for the project.

United States

Five firms, Uranium Resources Inc. (URI), Power Resources Inc. (PRI), TOTAL Minerals, Ferret Exploration of Nebraska, and UP Resources, did the bulk of exploration/feasibility work in the USA during 1990. Notably, only UP Resources was working on a conventional mining project; all of the others were pursuing in-situ leaching (ISL) projects.

URI has two projects located in South Texas. URI initiated production at its Rosita Project at a rate of about one million pounds U_3O_8 per year, while it maintained a similar annual capacity on standby at Kingsville Dome. URI continues to examine other targets, mainly in the Goliad Formation, the host for both Kingsville Dome and Rosita. URI also has two projects in New Mexico, Churchrock and Crown Point, with total recoverable resources exceeding 25 million pounds U_3O_8. URI is making significant progress toward permitting these two projects.

PRI is a wholly-owned subsidiary of Nuclear Electric, Great Britain's public nuclear power agency. In late 1990, PRI was successful in acquiring the Gas Hills properties of the Tennessee Valley Authority. This acquisition expands PRI's reserve base in central Wyoming to over 40 million pounds U_3O_8.

UP Resources continued drilling in northern Arizona with two rigs for most of the year. This program, a joint venture of UP Resources and Taiwan Power, is exploring and evaluating breccia pipe deposits. The joint-venture announced in 1990 that the Sage deposit was ready for development.

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TOTAL and Electricité de France (EdF) formed a new company named Fuel International Trading Corporation (FITCO), which, through a complex transaction, acquired the uranium-related assets of Malapai Resources. This acquisition gives FITCO significant resources and in-situ leach production facilities both in Texas and Wyoming. These facilities, in combination with TOTAL's operations (the West Cole project and a 45% interest in the Rhode Ranch open-pit mine), give FITCO a potential production capacity of several million pounds per year. Actual production in 1990 was about 1.5 million pounds equivalent U_3O_8. One new in-situ project, Alta Mesa, is in the permitting phase in Brook County, Texas.

Ferret Exploration is operator and part-owner of the Crow Butte ISL Project in northwest Nebraska. Well field development has been completed and the plant is nearly finished. Start-up is scheduled for early 1991 at a rate of 500 thousand pounds per year. The full capacity of one million pounds per year is not expected to be utilized until the market improves. Limited drilling has continued the definition of the main Crow Butte Trend to the north. Additionally, a second trend, Three Crows, has been defined about ten miles west of the new plant. Some drilling was also conducted on the Big Red deposit, south of the plant.

Other notable uranium activities in the USA involved Kennecott Corporation, Rio Algom Mining Corporation, and Uranerz. Kennecott, a subsidiary of RTZ, purchased a 50% interest in the Green Mountain, Wyoming project from US Energy. The joint-venture partners are evaluating alternative mining techniques for this deep deposit in the Battle Spring formation. Rio Algom, also a subsidiary of RTZ, is in the process of permitting its Smith Ranch, Wyoming, ISL project for a proposed capacity of two million pounds per year. Also in 1990, Uranerz received NRC permits for its Ruth and North Butte ISL projects.

North American Drilling Statistics

The average drill count in the US was about 10 per month in exploration and 14 in development. About twice as many rigs operate during the summer and fall, compared to winter and spring. In Canada, the reverse is true, with two-thirds of the drilling done in the winter when the ground and lakes are frozen. During the winter of 1989–1990, the maximum rig count reached fifteen in both the USA and Canada. This surface exploration effort was augmented with an average of five to ten underground drills all year long.

In both Canada and the US, funding for exploration comes increasingly from foreign investors. This event has been generally welcomed by industry and government, and is reflective of the worldwide market that has developed.

Tom Pool
Bob Steele

NUCLEAR INDUSTRY CALENDAR

1991

Feb. 27-28 ***Nuclear Safety: The Way Ahead*** (SAS Royal Hotel, Brussels, Belgium).
Co-Sponsored by the Belgian Nuclear Society, the British Nuclear Energy Society, and the Insitution of Nuclear Engineers.
Contact: Katie Lye or Louise Coote, IBC Technical Services Ltd; 44-71-236-4080.

March 24-27 ***Fuel Cycle Conference '91*** (Sheraton Scottsdale Hotel, Phoenix, Arizona).
Sponsored by the U.S. Council for Energy Awareness.
Contact: USCEA Conference Office; 202-293-0770; Telex: 7108249602; Fax: 202-785-4113.

April 8-10 ***Japan Atomic Industrial Forum Annual Conference*** (Tokyo, Japan).
Contact: Japan Atomic Industrial Forum; 3-508-2411; or Fax: 3-508-2094.

April 14-17 ***INFO '91 Conference*** (The Westin Hotel, Chicago, Illinois).
Sponsored by the U.S. Council for Energy Awareness.
Contact: USCEA Conference Office; 202-293-0770; Telex: 7108249602; Fax: 202-785-4113.

April 14-18 ***Third International Conference on Nuclear Fuel Reprocessing & Waste Management*** (Sendai, Japan).
Sponsored by the Atomic Energy Society of Japan and the Japan Atomic Industrial Forum, and co-sponsored by the American Nuclear Society and the European Nuclear Society.
Contact: Japan Atomic Industrial Forum; 3-508-2411; or Fax: 3-508-2094.

April 21-24 ***International Topical Meeting on LWR Fuel Performance*** (Palais des Papes, Avignon, France).
Sponsored by the American Nuclear Society and the European Nuclear Society.
Contact: Fragema, BP3021, F69398 Lyon Cedex 03, France; Tel: (33) 74 72 8159; Fax: (33) 74 72 8760.

April 22-25 ***JAIF International Conference on Water Chemistry in Nuclear Power Plants*** (Fukui, Japan).
Contact: Japan Atomic Industrial Forum; 3-508-2411; or Fax: 3-508-2094.

May 8-10 ***Second International Conference on Transportation for the Nuclear Industry***
(Bournemouth, United Kingdom).
Co-Sponsored by the Institution of Nuclear Engineers, the European Nuclear Society, the American Nuclear Society, the Chartered Institute of Transport, and the Institution of Civil Engineers.
Contact: INE Conference Secretary; 081-698-1500 or 081-698-4750; Fax: 018-695-6409.

May 12-14 ***World Nuclear Fuel Market Annual Meeting*** (Atlanta, Georgia).
Contact: Donna Cason, World Nuclear Fuel Market; 404-447-1144.

May 14-16 ***Annual Meeting on Nuclear Technology '91*** (Hotel & Congress Center Maritim, Bonn, Germany).
Sponsored by the Kerntechnische Gesellschaft e.V. and the Deutsches Atomforum e.V.
Contact: INFORUM GmbH, Congress Office JK'91, Heussallee 10, D-5300 Bonn 1, or 0228/507 223.

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CALENDAR

1991

June 2-6 ***American Nuclear Society Annual Meeting***
(Marriot Orlando World Center, Orlando, Florida).
Contact: ANS Meetings Department; 708-352-6611.

June 23-26 ***International Conference on Enrichment*** (The Westin Hotel, Washington, DC).
Sponsored by the U.S. Council for Energy Awareness.
Contact: USCEA Conference Office; 202-293-0770; Telex: 7108249602; Fax: 202-785-4113.

Sept. 4-6 ***Uranium Institute Sixteenth Annual Symposium*** (London, UK).
Contact: Uranium Institute; 44-71-225-0303; or Fax: 44-71-225-0308.

Sept. 22-25 ***International Uranium Seminar '91*** (The Don Cesar Hotel, St. Petersburg/Tampa, Florida).
Sponsored by the U.S. Council for Energy Awareness.
Contact: USCEA Conference Office; 202-293-0770; Telex: 7108249602; Fax: 202-785-4113.

Sept. 29-Oct. 2 ***American Mining Congress Mining Convention*** (Salt Lake City, Utah).
Contact AMC Convention Office: 202-861-2800; or Fax: 202-861-7535.

Nov. 10-13 ***Nuclear Energy Forum*** (Westin St. Francis Hotel, San Francisco, California).
Sponsored by the U.S. Council for Energy Awareness.
Contact: USCEA Conference Office; 202-293-0770; Telex: 7108249602; Fax: 202-785-4113.

Nov. 10-15 ***American Nuclear Society Winter Meeting*** (Hilton Hotel, San Francisco, California).
Contact: ANS Meetings Department; 708-352-6611.

1992

April 12-16 ***8th Pacific Basin Conference*** (Taipei, Taiwan).
Sponsored by the Amercian Nuclear Society.
Contact: ANS Meetings Department; 708-352-6611.

Sept. 21-23 ***Second International Conference on Training for Operation & Maintenance in the Nuclear Industry***
(The Moat House International Hotel, Stratford-upon-Avon, United Kingdom).
Sponsored by the Institution of Nuclear Engineers.
Contact: INE Conference Secretary; 081-698-1500 or 081-698-4750; Fax: 018-695-6409.

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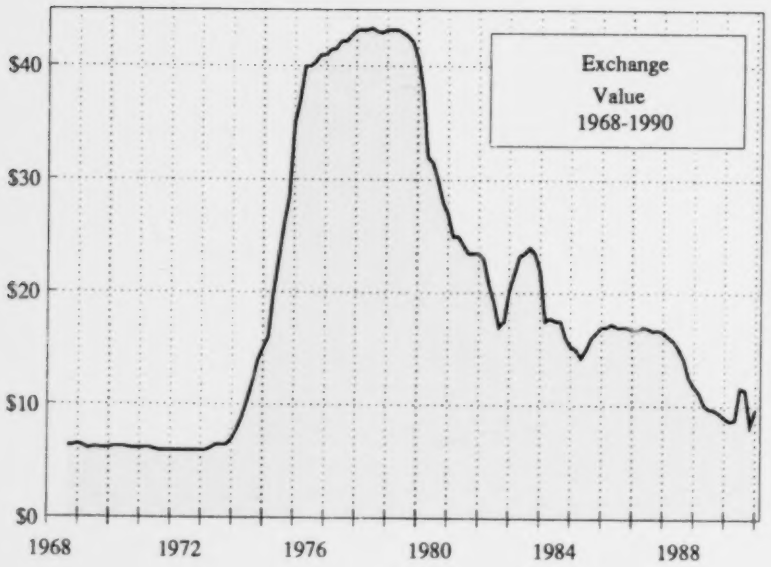
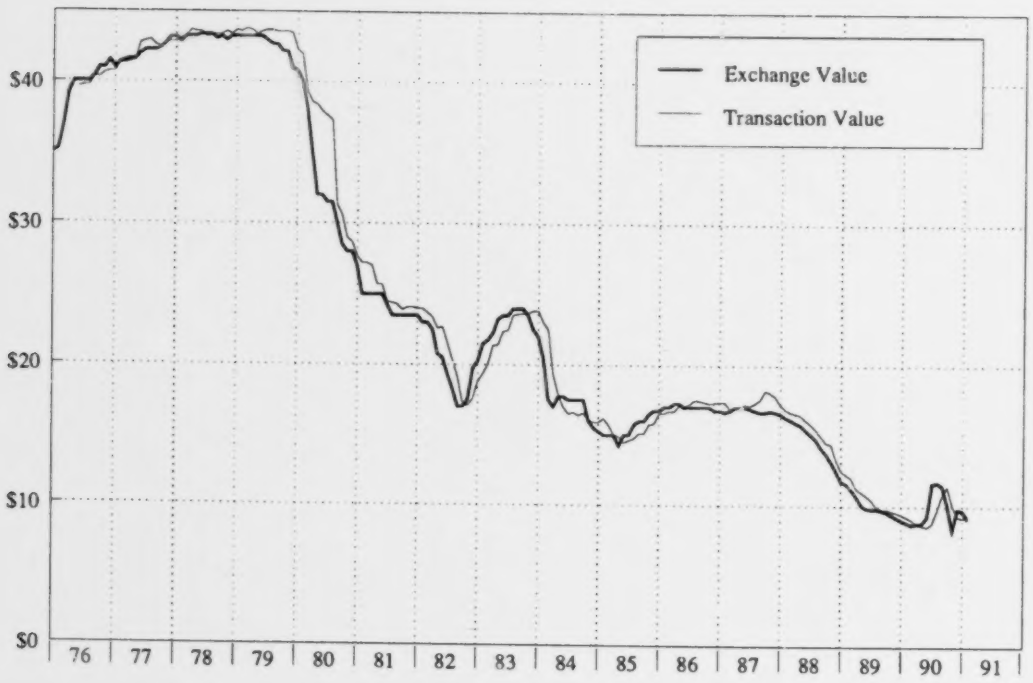
NUEXCO Historical Exchange Value and Transaction Value
(in US dollars per Pound U_3O_8)





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HISTORICAL MARKET DATA

HISTORICAL MARKET VALUES

Exchange Values

Year	Determined as of the last day of the month indicated ($US/lb U3O8)											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	15.75	16.00	16.00	16.50	16.75	17.00
1986	17.00	17.00	17.25	17.25	17.00	17.00	17.00	17.00	17.00	17.00	16.75	16.75
1987	16.65	16.75	17.00	17.00	17.00	16.90	16.75	16.65	16.65	16.75	16.65	16.55
1988	16.30	16.15	15.90	15.75	15.40	15.10	14.75	14.15	13.75	13.15	12.50	11.75
1989	11.60	11.20	10.70	10.10	9.85	9.80	9.80	9.70	9.60	9.40	9.20	9.00
1990	8.85	8.70	8.80	8.80	9.25	11.60	11.70	11.45	10.10	8.35	9.80	9.70
1991	**9.10**											

US Premium (Relative to the Exchange Value)

Year	Determined as of the last day of the month indicated ($US/lb U3O8)											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1986	—	—	—	—	—	—	—	—	—	—	0.65	0.75
1987	0.85	1.00	1.50	1.50	0.90	0.60	2.50	2.35	2.10	1.65	0.85	0.65
1988	0.70	0.50	0.15	0.25	0.60	0.00	0.00	0.00	0.00	0.00	**Discontinued**	

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UF_6 Values

Year	Determined as of the last day of the month indicated ($US/kg U as UF6)											
	Jan	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
1985	—	—	—	40.50	42.50	42.50	44.00	44.50	44.50	46.00	46.00	47.00
1986	47.00	48.00	48.00	48.50	48.25	48.25	48.25	48.00	48.00	48.00	48.00	47.75
1987	47.75	48.00	48.00	48.00	47.75	47.75	47.50	47.00	46.75	47.00	47.00	47.00
1988	46.50	46.00	45.50	45.25	44.75	44.00	42.75	41.00	40.75	39.00	37.50	35.50
1989	34.75	34.00	33.00	30.50	30.25	30.25	30.00	29.75	29.75	28.25	27.75	26.50
1990	25.90	25.25	24.40	24.40	25.50	32.00	32.50	32.25	29.50	24.75	28.75	28.75
1991	**27.50**											

US Premium (Relative to the UF_6 Value)

Year	Determined as of the last day of the month indicated ($US/kg U as UF6)											
	Jan	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
1986	—	—	—	—	—	—	—	—	—	—	2.50	2.50
1987	2.50	2.50	3.50	3.00	2.25	1.75	6.50	6.00	4.25	3.10	2.25	2.00
1988	1.25	1.25	0.50	0.50	1.00	0.00	0.00	0.00	0.00	0.00	**Discontinued**	

Conversion Values

Year	Determined as of the last day of the month indicated ($US/lb U as UF6)											
	Jan	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	1.60	1.60	1.60	1.60	1.60	1.60
1986	1.60	1.80	1.90	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.80	1.80
1987	1.80	1.80	1.80	1.80	1.80	1.80	1.90	1.90	1.90	1.90	1.90	1.90
1988	1.90	1.80	1.80	1.80	1.80	1.80	1.85	1.95	1.95	1.95	1.95	1.95
1989	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.90	1.90	1.80	1.75	1.65
1990	1.50	1.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45
1991	**1.45**											

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HISTORICAL MARKET DATA

Transaction Values

Year	Determined as of the last day of the month indicated ($US/lb U3O8)											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.80	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	14.75	15.10	15.10	15.75	15.80	16.55
1986	16.55	16.70	16.70	17.10	17.15	17.20	17.50	17.45	17.35	17.25	17.30	17.35
1987	17.35	16.90	16.95	17.00	17.20	17.10	17.30	17.55	18.20	18.05	17.80	17.20
1988	16.85	16.65	16.55	16.45	16.10	15.80	15.45	15.00	14.50	14.40	13.30	12.50
1989	12.25	12.00	11.25	11.00	10.75	10.45	9.95	9.80	9.80	9.65	9.55	9.40
1990	9.25	9.05	8.75	8.65	8.55	8.80	9.75	10.80	11.40	10.10	9.30	9.15
1991	**9.40**											

SWU Values

Year	Determined as of the last day of the month indicated ($US per SWU)											
	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
1986	80	80	80	80	75	78	78	78	78	78	80	80
1987	80	80	77	77	75	73	75	75	73	69	73	73
1988	73	73	70	68	68	68	68	65	65	65	65	65
1989	65	67	67	67	66	66	66	65	63	59	57	54
1990	54	50	50	50	50	50	50	50	50	51	51	51
1991	**51**											

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Loan Rates

Year	Determined as of the last day of the month indicated (Percent per Annum)											
	Jan	**Feb**	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
1968	—	—	—	—	—	—	—	4.00	4.00	4.00	4.00	4.00
1969	4.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	6.00	6.00	6.00	6.00
1970	6.00	6.20	6.40	6.50	6.50	6.50	6.50	5.00	6.50	6.00	5.50	5.50
1971	5.00	4.75	4.75	4.75	5.00	5.25	5.25	5.25	5.25	5.25	4.50	4.50
1972	4.00	4.00	4.00	4.50	4.50	4.50	5.00	5.00	5.00	5.00	5.00	5.00
1973	5.50	5.50	5.75	5.75	6.00	6.25	7.00	7.00	7.00	7.00	7.50	8.00
1974	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
1975	8.00	7.00	7.00	7.00	7.00	6.50	6.50	6.50	6.50	6.50	6.50	6.50
1976	6.50	6.50	6.50	6.50	*	*	*	*	*	*	*	*
1977	*	*	*	*	6.50	6.50	6.50	6.75	7.25	7.25	7.25	7.25
1978	7.25	7.00	7.00	7.00	7.00	7.50	7.75	7.75	7.75	7.00	7.00	7.00
1979	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1980	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1981	7.00	7.00	7.00	7.00	7.00	5.50	5.50	5.50	5.50	6.00	6.00	6.00
1982	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1983	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1984	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
1985	6.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1986	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
1987	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	3.50	3.50
1988	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1989	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1990	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
1991	**3.50**											

* Float with Prime Rate

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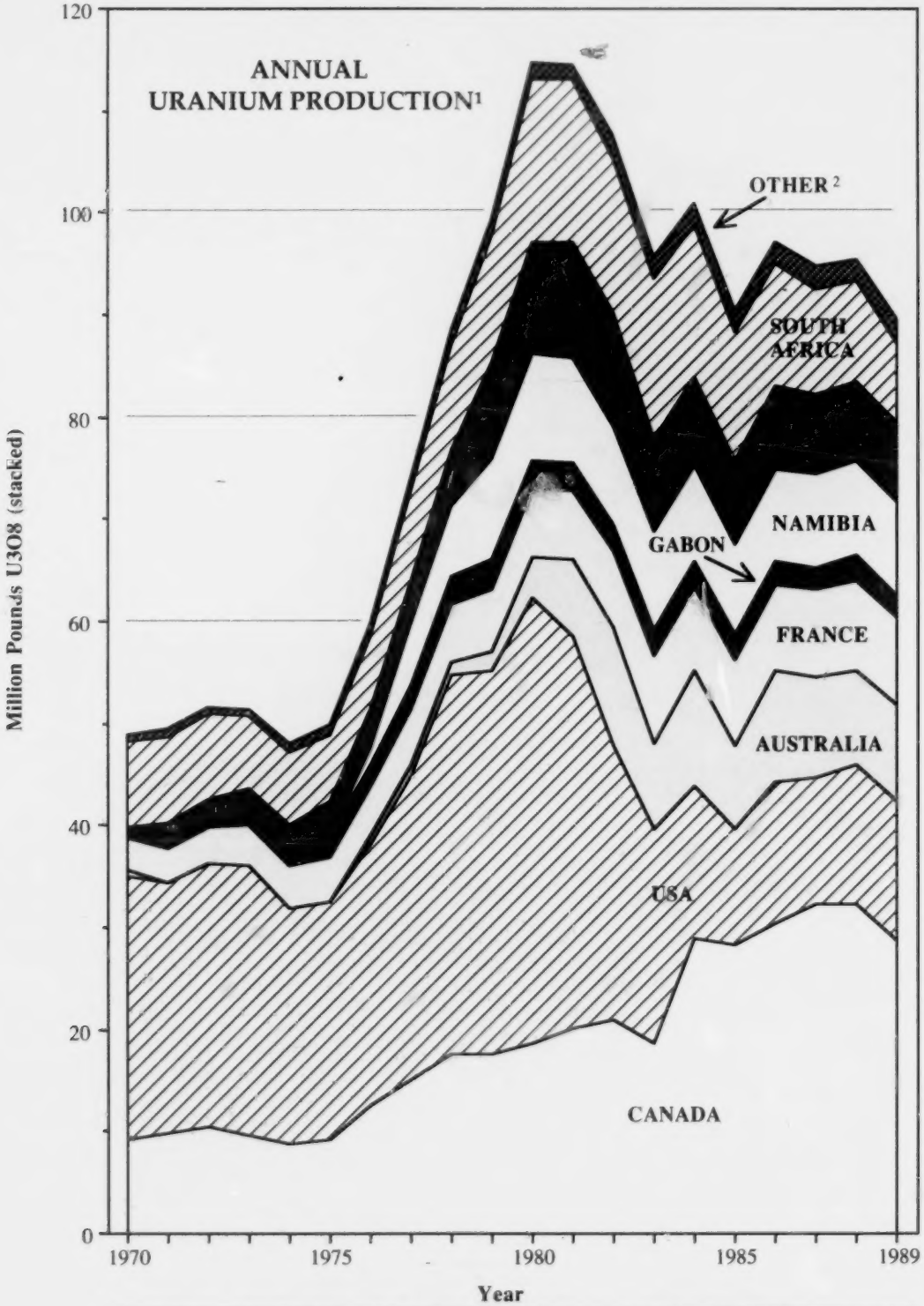
HISTORICAL MARKET DATA



[1] Estimated world production in 1989 totalled 89.6 million pounds (Australia—9.5; Canada—28.7; France—8.5; Gabon—2.2; Namibia—9.2; Niger—7.7; South Africa—7.7; USA—13.7; Others[2]—2.3).

[2] **Other** includes: Argentina, Belgium, Brazil, India, Pakistan, Portugal, Spain, (West) Germany, and Yugoslavia

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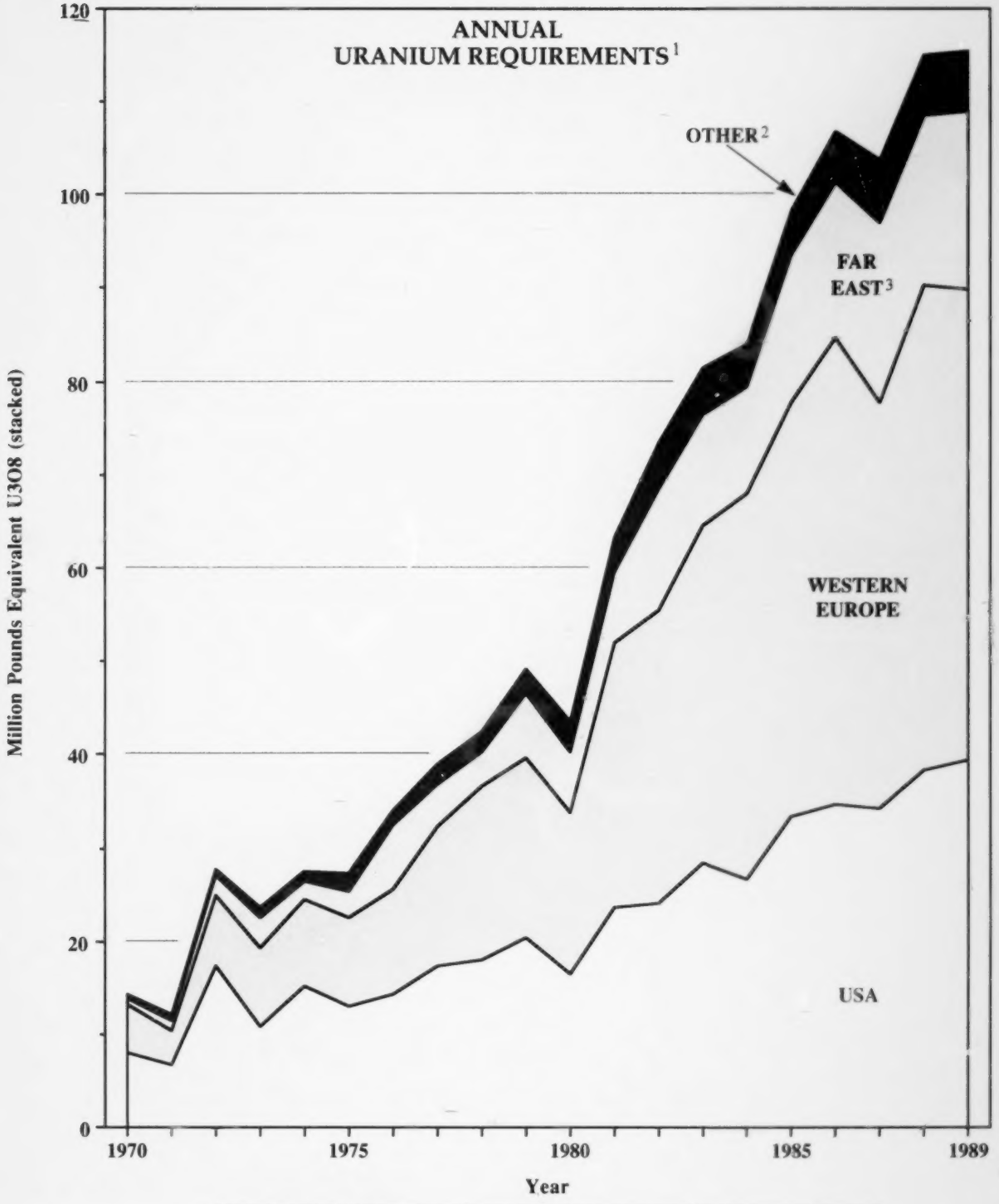

[1] Calculated by NUEXCO based on actual completion dates and operating performance, and NUEXCO's estimate of enriching tails assays.

[2] **Other** include: Argentina, Brazil, Canada, India, Mexico, Pakistan and South Africa.

[3] Does not include Peoples Republic of China.

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GOVERNMENT STATISTICS

Australia

Year	Period[1]	Consumer Price Index[2] (1980/1981 = 100)	Price Index of Materials Used in Manufacturing Industry — All Groups[3] (1984/1985 = 100)	Average Weekly Ordinary Time Earnings — Adult Males — Australia[4] (Australian dollars)	Award Rates of Pay Indexes Australia - Adult Males In Mining Wage Earners, Weekly Rates[5] (June 1985=100)
1980	Avg.	95.8	83.1	—	140.8[6]
1981	Avg.	105.0	85.9	—	154.1[6]
1982	Avg.	116.7	89.0	—	174.9[6]
1983	Avg.	128.5	96.9	—	181.9[6]
1984	Avg.	133.6	98.0	—	194.4[6]
1985	Avg.	142.6	107.3	—	103.7
1986	Avg.	155.5	101.5	—	106.1
1987	Avg.	168.7	108.9	465.88	112.3
1988	Avg.	180.9	111.8	496.90	115.2
1989	Avg.	194.6	117.0	534.65	126.0
Jan	1990	—	119.2	—	128.1
Feb	1990	—	120.8	—	128.1
Mar	1990	204.1	121.5	—	128.3
Apr	1990	—	119.9	—	128.5
May	1990	—	118.9	—	128.8
June	1990	207.4	116.6	—	129.2
July	1990	—	116.4	—	129.4
Aug	1990	—	122.4	—	129.4
Sept	1990	208.9	128.2	—	129.6
Oct	1990	—	134.1	—	—
Nov	1990	—	133.7	—	—

P = Preliminary **R** = Revised since last month

[1] Monthly data for the period 1967 to 1986 appears in Report 233 (January 1988).
[2] Weighted average of six State capital cities (1975 to 1980), and eight capital cities from 1981 (Base: Financial year July 1980 to June 1981 = 100.0). Figures shown at end of quarter represent quarterly average.
[3] Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).
[4] Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.
[5] Australian Bureau of Statistics, Canberra: "Average Weekly Earnings, States & Australia" (Catalogue No. 6302.0).
[6] Base: June 1976 = 100.

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Canada

		Industrial Products Price Index: All Commodities [1] (1986 = 100) [2]	Consumer Price Index: All Items (1986 = 100) [3]	Wage-earner Data: Average Hourly Earnings (C$) [4] Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells (SIC 051-099)	Metal Rolling, Casting and Extruding (SIC 298)	Chemicals and Chemical Products Industries (SIC 372-379)
1980	Avg.	75.7	67.1	—·—	—·—	—·—	—·—	—·—
1981	Avg.	83.4	75.5	—·—	—·—	—·—	—·—	—·—
1982	Avg.	89.0	83.7	—·—	—·—	—·—	—·—	—·—
1983	Avg.	92.1	88.5	17.22	—·—	14.18	10.67	11.10
1984	Avg.	96.3	92.3	17.89	—·—	14.97	11.11	11.68
1985	Avg.	99.0	96.0	18.53	16.48	15.56	11.85	12.12
1986	Avg.	100.0	100.0	19.38	16.70	15.76	12.28	12.58
1987	Avg.	102.4	104.4	20.12	17.15	16.11	12.58	13.20
1988	Avg.	106.9	108.6	20.91	18.51	16.95	13.17	13.77
1989	Avg.	109.4	114.0	21.97	20.02	18.41	13.71	14.16
1990	Avg.	109.7	119.4	—·—	—·—	—·—	—·—	—·—
Jan	1990	108.7	116.9	21.88	20.39	19.03	13.99	14.78
Feb	1990	109.5 R	117.6	22.51	20.63	19.14	14.49	15.03
Mar	1990	109.3 R	118.0	22.52	20.75	19.17	14.99	15.07
Apr	1990	109.1	118.1	23.17	21.20	19.46	14.83	14.93
May	1990	109.6 R	118.7	23.28	20.55	19.01	14.71	15.06
June	1990	109.4	119.2	21.85	20.63	18.96	14.69	15.05
July	1990	109.1	119.8	20.92	20.18	18.66	14.34	15.20
Aug	1990	109.2	119.8	23.88	20.51	18.59	14.50	15.33
Sept	1990	110.2 R	120.2	24.41	21.19	18.94	14.48	15.63
Oct	1990	110.6 R	121.2	23.11	21.39 R	19.12 R	14.78 R	15.59 R
Nov	1990	110.7 R	121.9	23.32 P	21.71 P	19.43 P	14.87 P	15.73 P
Dec	1990	110.5	121.8	—·—	—·—	—·—	—·—	—·—

P = Preliminary **R** = Revised since last month

[1] Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision. This category was formerly known as "Manufacturing." Monthly data for the period 1967 to 1986 is found in Report 233.

[2] New Base Year of 1986 as of Report 266. Previous Base Year was 1981. All figures in column recalculated by 0.791 multiplier.

[3] New Base Year of 1986 as of Report 264. Previous Base Year was 1981. All figures in column recalculated by 0.755 multiplier.

[4] Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours." Monthly data for the period 1983 to 1986 is found in Report 233.

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GOVERNMENT STATISTICS

South Africa

		Average Declared Working Costs per Metric Ton of Gold Ore Milled [1] (Rand)	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled [2] (March 1982 = 100)	Consumer Price Index [3] (1985 = 100)	Production Price Index All Groups [4] (1985 = 100)	Total Employment in Mining and Quarrying [5]	Total Salaries and Wages in Mining and Quarrying [5] (1,000 Rand)
							Annual Total [6]
1980	Avg.	35.53	—	51.9	55.2	709,042	2,237,689
1981	Avg.	41.89	—	59.8	62.7	722,918	2,756,928
1982	Avg.	47.25	104.2	68.6	71.4	702,041	3,181,584
1983	Avg.	51.88	115.0	77.1	79.0	700,901	3,563,282
1984	Avg.	58.95	130.3	86.0	85.6	711,511	4,134,390
1985	Avg.	68.76	151.6	100.0	100.0	724,587	4,778,612
1986	Avg.	80.22	177.9	118.6	119.5	756,637	5,767,950
1987	Avg.	95.01	223.1	137.7	136.2	751,864	6,911,395
1988	Avg.	106.69	241.1	155.4	154.1	705,355	7,774,054
1989	Avg.	116.65	273.0	178.2	177.5	700,360	8,833,934
							Monthly Total
Jan	1990	—	—	192.0	188.8	688,837	801,616
Feb	1990	—	—	193.3	190.3	674,026	767,274
Mar	1990	126.74	296.3	196.4	190.9	704,660	780,614
Apr	1990	—	—	198.3	194.1	696,107	810,474
May	1990	—	—	200.4	196.3	613,527	719,191
June	1990	128.25	299.87	201.8	197.0	676,621	841,165
July	1990	—	—	203.2	197.2	697,242 R	913,177 R
Aug	1990	—	—	206.5	199.8	686,385	902,392
Sept	1990	129.46	312.55	209.7	203.2	668,282	876,527
Oct	1990	—	—	211.1	206.1	—	—
Nov	1990	—	—	215.6	214.9	—	—
Dec	1990	—	—	217.1	—	—	—

P = Preliminary R = Revised since last month

[1] Chamber of Mines of South Africa, Johannesburg: "Analysis of Working Results," published quarterly. Historical Data by month appears in Report 236.
[2] Page 16 of Report 178 contains description and calculation of index, and page 24 of Report 178 lists figures for 1982.
[3] Central Statistical Service, Pretoria: All income groups-weighted average, Historical Data by month appears in Report 236.
[4] Central Statistical Service, Pretoria: All commodities for consumption in South Africa.
[5] Central Statistical Service, Pretoria: Historical Data by month appears in Report 236.
[6] Annual total is shown, rather than monthly average, for indicated year.

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United States

		Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
		Industrial Commodities (1982 = 100)	All Commodities (1982 = 100)	(1982-1984 = 100)	(1982 = 100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1980	Avg.	88.0	89.8	82.4	85.7	10.26	10.63	8.30	6.94
1981	Avg.	97.4	98.0	90.9	94.0	11.55	11.98	9.12	7.62
1982	Avg.	100.0	100.0	96.5	100.0	12.31	12.93	9.96	8.21
1983	Avg.	101.1	101.3	99.6	103.9	12.58	13.43	10.58	8.67
1984	Avg.	103.3	103.7	103.9	107.7	13.05	13.43	11.07	9.04
1985	Avg.	103.7	103.2	107.6	110.9	13.38	13.74	11.56	9.46
1986	Avg.	100.0	100.2	109.6	113.9	12.46	13.48	11.98	9.65
1987	Avg.	102.6	102.8	113.6	117.7	12.52	12.98	12.37	9.88
1988	Avg.	106.3	106.9	118.3	121.3	13.24	13.26	12.71	9.79
1989	Avg.	111.6	112.2	124.0	126.3	13.59	13.72	13.09	10.05
1990	Avg.	115.8	116.3	130.7	131.5	—·—	—·—	13.53 P	10.37 P
Jan	1990	114.1	114.9	127.4	—	13.69	13.95	13.34	10.13
Feb	1990	113.6	114.4	128.0	—	13.70	13.99	13.27	10.16
Mar	1990	113.2	114.2	128.7	129.7	13.80	14.04	13.34	10.17
Apr	1990	113.2	114.1	128.9	—	13.92	14.30	13.53	10.17
May	1990	113.5	114.6	129.2	—	13.96	14.16	13.46	10.22
June	1990	113.2	114.3	129.9	131.0	14.00	14.31	13.51	10.27
July	1990	113.4	114.5	130.4	—	14.29	14.49	13.58	10.34
Aug	1990	115.9	116.5	131.6	—	14.27	14.60	13.57	10.33
Sept	1990	118.3	118.3	132.7	132.2	14.41	14.48	13.62	10.42
Oct	1990	121.3	120.8	133.5	—	14.43	14.58 R	13.72 R	10.47
Nov	1990	120.6	120.1	133.8	—	14.36 P	14.77 P	13.73 R	10.51 R
Dec	1990	118.9	118.6	133.8	133.1	—·—	—·—	13.69 P	10.59 P

P = Preliminary **R** = Revised since last month

[1] US Bureau of Labor Statistics, Washington, DC: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents. Historical data is presented in Report 233.

[2] US Bureau of Labor Statistics, Washington, DC: Consumer Price Index for All Urban Consumers, US City Average, All Items. Historical data is presented in Report 233.

[3] US Department of Commerce, Washington, DC: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted. Historical data is presented in Report 233.

[4] US Bureau of Labor Statistics, Washington, DC: "Employment and Earnings." All data based on 1972 revision of SIC Manual. Historical data is presented in Report 233.

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GOVERNMENT STATISTICS

Volume and Price of Uranium Deliveries To The European Community [1]

— Compiled from data published by the Euratom Supply Agency —

Year	Volume of Deliveries to the EC [2] (MTU)	Percentage of Deliveries Made Under Spot Contracts	Medium or Long-Term Contracts [3] Average Price		Spot Contracts [3] Average Price	
			in ECU per pound U_3O_8	in US Dollars per pound U_3O_8	in ECU per pound U_3O_8	in US Dollars per pound U_3O_8
1977	n/a	n/a	n/a	n/a	n/a	$41.00
1978	n/a	n/a	n/a	n/a	n/a	$43.00
1979	10,000	n/a	n/a	n/a	n/a	$44.50
1980	8,600	n/a	n/a	$36.00	n/a	$35.00
1981	13,000	less than 10	n/a	$33.25	n/a	$28.00
1982	12,500	less than 10	ECU 32.25	$32.00	ECU 24.25	$24.00
1983	13,500	less than 10	ECU 34.75	$31.00	ECU 26.00	$23.25
1984	11,000	less than 10	ECU 37.75	$29.75	ECU 24.50	$19.25
1985	11,000	11.5	ECU 38.00	$29.00	ECU 19.50	$15.00
1986	12,000	9.5	ECU 31.50	$31.00	ECU 18.00	$17.75
1987	14,000	17.0	ECU 28.25	$32.50	ECU 15.00	$17.25
1988	12,500	4.5	ECU 26.92	$31.82	ECU 13.65	$16.13
1989	13,500	11.5	ECU 26.63	$29.35	ECU 11.04	$12.19

P = Preliminary **R** = Revised since last month

[1] The twelve European Community member nations are Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, and the United Kingdom; prior to January 1986, Spain and Portugal were not members of the EEC.

[2] The only deliveries taken into account are those made to final users, namely the electric utilities or their procurement organizations; deliveries to middlemen or fuel cycle companies are not included. The sales between utilities in the Community are also excluded. The quantities covered are those which were entered into accounting records during the year stated.

[3] For deliveries made under medium or long-term contracts (i.e., for which the time between the date of signature and the date of the last delivery exceeds one year) the prices were expressed in seven different currencies. In order to calculate an average price, these prices have been converted into European Currency Units (ECU) and US dollars. The average prices were weighted by quantity and converted on the basis of the average annual exchange rate of the different currencies against the ECU and US dollar. Exchange rates are published by European Communities Statistical Office and the International Monetary Fund.

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US Uranium Marketing Activities Statistics

— Compiled from data published by the US Energy Information Administration [1] —

Year	Total Production (million pounds U_3O_8)	Deliveries to Domestic Utilities From US Suppliers [2] (million pounds U_3O_8)	Average Price of Delivered Uranium [2] ($/lb. U_3O_8)	Quantity of Uranium Imported [3] (million pounds U_3O_8)	Average Price of Imported Uranium ($/lb. U_3O_8)	Quantity of Uranium Exported (million pounds U_3O_8)
1976	25.5	27.6	$16.10	3.6	n/a	1.2
1977	29.9	27.8	$19.75	5.6	n/a	4.0
1978	37.0	31.6	$21.60	5.2	n/a	6.8
1979	37.5	33.0	$23.85	3.0	n/a	6.2
1980	43.7	35.0	$28.15	3.6	$43.10	5.8
1981	38.5	32.6	$34.65	6.6	$32.90	4.4
1982	26.9	23.5	$38.37	17.1	$25.19	6.2
1983	21.2	24.2	$38.21	8.2	$26.16	3.3
1984	14.9	22.5	$32.65	12.5	$21.86	2.2
1985	11.3	21.7	$31.43	11.7	$20.08	5.3
1986	13.5	18.9	$30.01	13.5	$20.07	1.6
1987	13.0	20.8	$27.37	15.1	$19.14	1.0
1988	13.1	17.6	$26.15	15.8	$19.03	3.3
1989	13.8	18.4	$19.56	13.1	$16.75	2.1

P = Preliminary R = Revised since last month

[1] Sources: 1976-1983: US Department of Energy/Energy Information Administration, *Survey of United States Marketing Activity.*
1984-1989: Energy Information Administration, *Uranium Industry Annual.*

[2] Data for 1976-1981 includes both domestic utilities and agents.

[3] Includes imports by domestic utilities and domestic suppliers.

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